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THE COASTAL PEOPLE OF KELANTAN AND TRENGGANU, MALAYA

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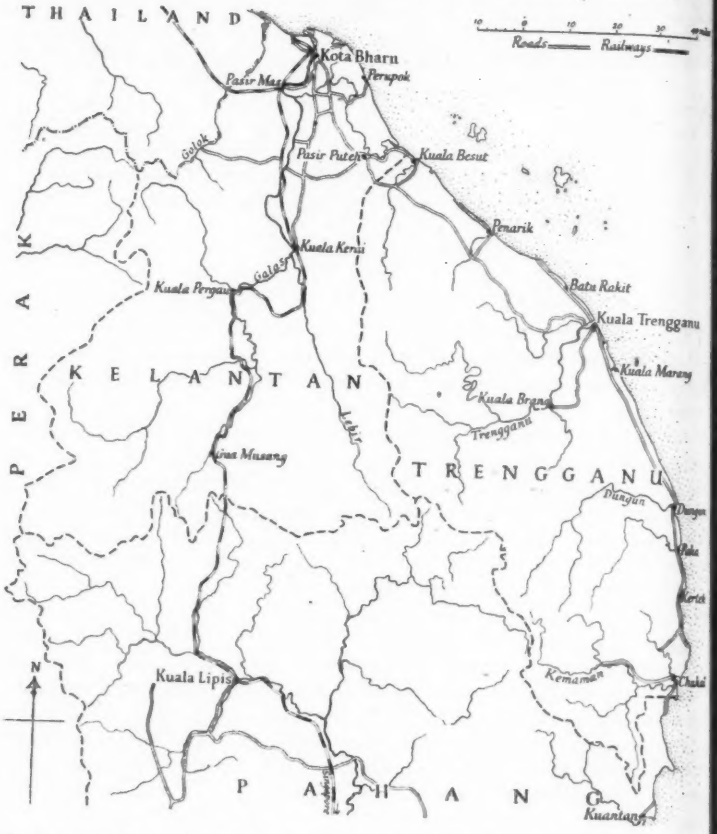
IT is only a year since Malaya fell into Japanese hands. Yet so much has happened since then, to focus attention elsewhere and to blur our impressions of the country and its people, that no excuse is needed for reviewing some aspects of a region which even before the war was not well known to many Europeans. In discussing the coastal Malays of Kelantan and Trengganu I am drawing upon a year's experience in 1939 and 1940. With the facilities given me by a Leverhulme Research Fellowship—and I should like to take this opportunity of acknowledging my debt to the Committee of this foundation—I was engaged in a study of Malay peasant economy in that region. In this work I had the invaluable help of my wife. Her investigations among the peasant women, into domestic affairs, household budgets, and diet, covered a range of topics essential to an economic study, yet almost impossible for a man to have handled in that Moslem community, unfanatical and easy-going as the people are. My own research lay mainly among the men: at sea, on the beach, in the rice-fields. I discussed with them their boats and types of nets, their methods of fishing and cultivating, fish prices and marketing, vegetable gardening, their capital and debts, their magical and religious beliefs about the sea and about crops; and observed the many complex details of the organization which is necessary to make even an apparently simple peasant economy work.

But for an economic study of this kind general observations are not enough. One must have series of quantitative data as well, to give a solid basis and to correct impressions. Official statistics were of necessity almost entirely lacking, so I had to collect my own. Each day I took records of the number and kind of boats and nets at sea, the size of their crews, the type of fish they brought in, and the prices at which the catches were sold. As one instance, I followed thus for six months the fortunes of the lift-net fishing, the basic occupation of the area, which had usually about twenty nets, one hundred

boats, and four hundred or more men at sea each day. From such material one can calculate ranges of income and their general level, if one knows the scheme by which the earnings are apportioned. Again, to get an idea of the capital invested, I noted each boat and net in the area, how it was owned, and its approximate value. To measure the agricultural position I took a production census of more than two hundred rice plots, covering more than 50 acres, noting ownership, type of cultivation and yield, and similarly with



forty vegetable gardens. And to assist us in estimating the standard of living my wife and I took a personnel and property census of about three hundred and thirty households.[1]

During most of this time we lived in a fishing village near Perupok on the

[1] Some of the results of this census, with her analysis of household budgets and other material have been published by my wife: Rosemary Firth, 'Housekeeping among Malay peasants,' *London School of Economics*: Monographs on Social Anthropology, No. 7, 1943.

Kelantan coast, to get that day-to-day intensive knowledge of conditions which is necessary in order to understand any system of economic life. Equipped with only a little standard Malay at the start, we had to learn the local dialect. It is not easy to understand, rather like broad North Country as against Southern English, and we spoke it haltingly at first. But we gained fluency as the months went by. Near the end of our stay we went on a month's tour in Trengganu to make a comparative study of fishing methods and organization; there we were recognized by our accent as coming from Kelantan.

These few details illustrate one type of work done by a social anthropologist. The time has gone by when anthropologists studied only savages in isolated primitive communities. The modern social anthropologist is concerned with the life of any people who are not an integral part of an industrial civilization, that is, whose institutions and habits are sufficiently different from our own. The Malay peasant fisherman was faced long before the war by the problems of adjusting himself to the presence of European administration, Chinese competition, and large-scale capitalist enterprises in rubber and tin, as well as to partial contact with a system of world markets. Now he has had to endure whatever new burdens the Japanese may have thrust upon him. After the war he will need help, no less than the rubber estate or the tin-mining company or the Chinese shopkeeper. And such help, to be effective, will demand a knowledge of his economy, his resources, and his needs—all set against the background of geographical conditions in which his new life must develop.

In the coastal region of Kelantan and Trengganu the physical setting clearly determines the economic and even the social conditions of the people to a large extent. By comparison with the west of Malaya the two States mentioned are comparatively isolated; their coastline is defined by long sandy beaches instead of by muddy inlets and mangrove swamps; the regulating factor in the economic cycle is the north-east monsoon from the China Sea instead of the south-west monsoon of the Indian type; their mineral resources are of comparatively low grade.

Cut off by the main mountain ranges of the peninsula into a kind of north-eastern pocket, Kelantan and Trengganu have poor communications. There is only one railway linking up with the west, and no good roads lead out. The sand bars thrown up at the river mouths by the monsoon block the development of good ports, consequently much of the shipping is by small native craft. Most of the rivers are not bridged, and are crossed by punt or by Malay sailing ferry. There are few estates or mines, few Europeans, and relatively few Chinese. The population is predominantly Malay (about 89 per cent. in Kelantan and 93 per cent. in Trengganu by the last estimate) and primarily peasant in character, engaged in small-scale agriculture and fishing. Most of the country is rugged. Except on the great plain of the Kelantan river, and the smaller plains of the Besut and the Trengganu, the population is mainly distributed along the coast. The towns are small. It is a Malay society, largely homogeneous in its culture, but spread out in village communities.

The long sandy beaches run for miles, almost flat, or with a gentle slope,

cut at times by the shallow outlet of a watercourse or at long intervals by the mouth of a river, which gives a harbour. These harbours are usually of a characteristic form: a granite ridge runs out to the south-east, and behind it, on the south side, the river meanders to the sea, with sand spits and a sand bar almost closing its mouth. The sand spit is usually most developed on the southern side, owing to the effects of the north-east monsoon, and inside it there is usually a wide estuary. In this any craft that can pass the bar may lie at anchor and much fishing is done from there. But because fish of pelagic and demersal types are to be found almost anywhere off the coast, and because harbours are scarce, many fishing craft use the open ocean beach. They cannot lie off the beach for fear of storms; they must be drawn up. They can be hauled up anywhere, but the people have no mechanical gear, so the size of the boats is limited by what the crew can handle. Because the fish are landed on the beach in the afternoon, it serves as a market place, drawing crowds of dealers, housewives, and children when the boats come in. And furthermore, because on many long stretches there are wide belts of firm sand, the beach also becomes a highway for foot travellers and cyclists, and in parts, as in the south of Trengganu, even for light motor buses. In short, the beach is a focus for the life of the region that lies behind it.

Immediately behind the beach lies the usual vegetation of coarse grass, creeping plants, and straggling bushes, with occasional casuarina trees, especially in Trengganu, where the Malay word *ru* for casuarina occurs in many place-names. At intervals, in the more populated stretches, are belts of coconut palms, with the houses of the fisherfolk scattered among them. A few of the richer are roofed with red tiles; most are thatched, and nearly all are of light construction, with bamboo walls. The soil is hot and sandy, and gardens are few; most of these people get their living from the sea, though some have rice fields and vegetable gardens inland. The influence of the monsoon is seen in the tall wind-breaks of coconut fronds which are put up on the seaward side about November, as the season of high winds draws near.

A hundred yards or so farther inland there is frequently a characteristic formation of old raised beaches running parallel to the sea in the form of sandy ridges (known as *gong*) separated by watercourses (*alur*). Some of these watercourses are swampy, but most are dry for the greater part of the year, filling only with the monsoon rains. In August and September they are ploughed and planted with rice; after the harvest, about March, they provide pasture for cattle and goats. On the sandy ridges there are orchards of coconut palms and fruit trees, vegetable gardens, and more houses. Farther inland again the country changes. In Kelantan there is the great plain, with its rice fields and settlements on knolls; in Trengganu for the most part the wooded foothills begin.

In both Kelantan and Trengganu sea fishing and the secondary occupations connected with it form a major industry. At a conservative estimate I would place the number of fishermen alone in Kelantan at not less than six thousand five hundred men, and in Trengganu at not less than ten thousand—in all nearly half the total Malay fishermen in the peninsula. The average output of wet fish before the war was probably about 9000 tons per annum from Kelantan, worth about three-quarters of a million dollars, and from

Trengganu about 14,000 tons, worth about one million dollars. (The dollar was worth two shillings and four pence.) In every Malay community fish is a most important item in the diet. The people do not eat much meat, largely because they cannot afford it, and fish is their main source of animal fat and protein. It is an important article of commerce all through the country, even in remote jungle villages, and an elaborate organization of transport and marketing has been built up to convey it. To the towns and villages near the coast it is carried fresh in baskets on poles by foot runners, on bicycles, on light motor buses, and even in hired cars. The carriers, who are often the actual middlemen too, wait where the boats unload, ready to snap up the fish and dash off with it to catch the market before the day gets late. Other dealers, whose main business lies in sun-drying or pickling fish for more remote areas, or a future market, wait their turn to buy in bulk, at cheaper rates, when the demand of the fresh fish traders has been satisfied.

In the coastal villages the life of the community revolves around the fishing. In the area where we lived, with a total population of about one thousand three hundred, 75 per cent. of the men had fishing as their primary occupation, and another 10 per cent. were fish dealers, while many of the women and children helped with the work. The point here is that this is not a subsistence economy; fish for their own food is important, but the main object is the cash income to be got from it, for the purchase of rice, vegetables, spices, cloth, and many other imported articles of food and other types of goods. The fishing communities are not economically isolated: they take part in a general system of exchange in the country as a whole; they have elaborate marketing and credit arrangements with shopkeepers and others outside fishing circles; they are as dependent on the agriculturalists and townsfolk as these are upon them. The converse of this is of course that their incomes and standards of living are sensitive to fluctuations in the general economic system. Depressed markets for rubber and tin, upheavals such as strikes, cessation of labour migration, change of government or war hit them just as they hit any peasant community which has come into contact with the fringe of the industrial world.

The production side of the fishing is complex. A great variety of methods are used on the Kelantan–Trengganu coast: hand-line for sea bream; troll for Spanish mackerel; a large square lift-net for horse mackerel; a light gill net for sardines and sprats; a ring of deep gill nets for ordinary mackerel at night, or for jewfish by day; a light drift net for inshore work with prawns and mixed fish by day; a heavy drift net for sharks, rays, and pomfret by night; a seine for scabbard-fish, catfish, and other types close to the shore; several kinds of purse-net for rather similar kinds far out; a shrimp-net just off the beach, or an occasional casting net. At least a dozen methods, without counting such eccentricities as fishing for squid with a tiny grapnel on the banks offshore, or scooping up grey mullet in the breaking waves off the beach at the height of the monsoon. Each has its own technique, its own organization; some even have their own magic rites. Some rest upon individual skill, others upon complex cooperation; some call for little capital, others demand a heavy initial outlay; some have a very short season, others can be followed for most of the year. Nearly all involve the use of boats. The upshot is that there are plenty of openings for individual capacity—the man

with money to invest in a boat or a net, with knowledge and skill to use, o with nothing but his labour to offer has a chance to fit himself in and get living.

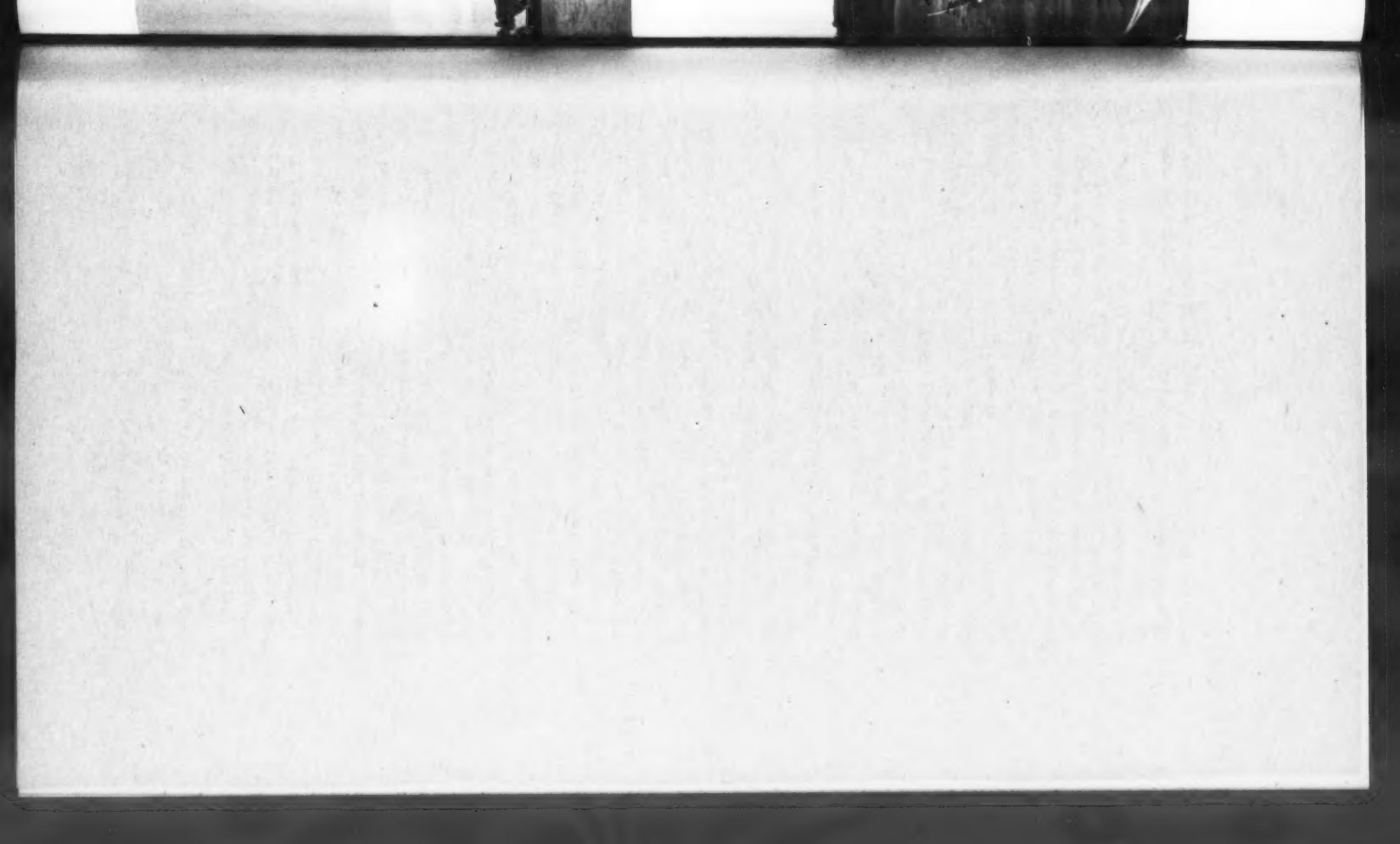
It is impossible to examine each type of fishing here, but one example ma be taken: the use of the deep gill net (*pukat dalam*) in the Perupok area This net is made locally, of imported cotton yarn, and has a mesh of abou $2^1/_2$ inches, with wooden floats and sinkers cast from lead. Like most of the other nets, it is dyed brown with mangrove bark. It is made up of abou twenty separate oblong sections (the number actually observed varie between seventeen and twenty-six sections). Each of these, called *utak*, i about 8 fathoms long, and 7–9 fathoms deep. When joined up for use the form a circuit (*likung*) of 250–350 yards circumference (the Malay fathom being an arm-stretch, is rather less than 6 feet). The cost of the net varie according to size and the price of yarn, etc., but ranges between about eigh and fifteen dollars per section; the usual price quoted in 1940 was ten dollars section, making about two hundred dollars as the normal cost of a complete net

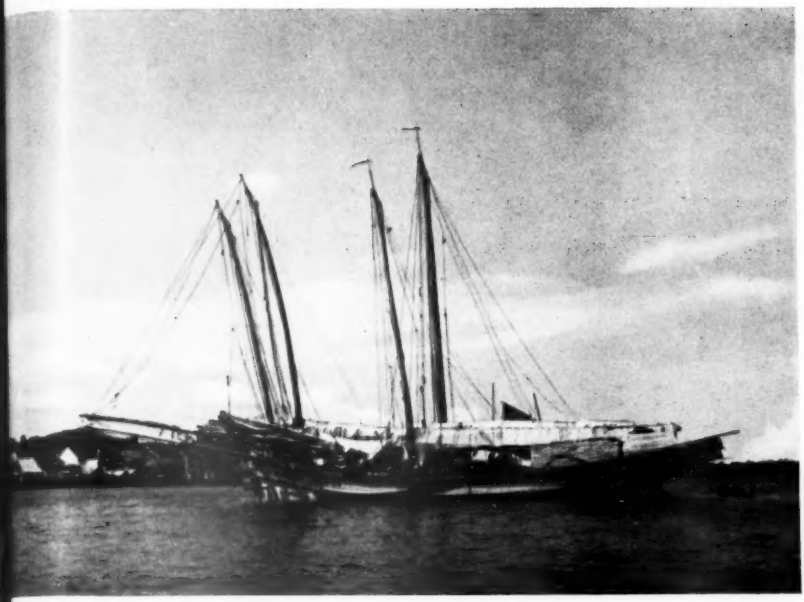
Nearly all the other types of nets are owned individually, but this deep gil net is owned by sections, usually among four or five men. It is common fo one man, the owner of the boat used, to have about ten sections himself, and for the other men to own two to four sections apiece. One feature of this ne is that it gives a man with only a moderate amount of capital a chance o investing it in a fairly large organization, and one that usually earns a goo profit. On the other hand, it is a rather speculative investment; the mai types of take are apt to appear irregularly and for a short time. Some of th less wealthy fishermen therefore prefer to have their money in equipmen that gives them a steadier if smaller yield, for instance a small drift net whic they can use day in, day out.

The deep gill net is used in two ways, by day and by night. For fishing b day two boats and two nets are used in combination, each with a crew o about ten men.

The boats are launched soon after dawn and sail out with the land breeze They go from $^1/_2$ to $1^1/_2$ miles offshore, each with its net aboard and fish i about 5 fathoms. With them is a tiny canoe, the *sampan*, paddled by th *jurusĕlam*, the expert fisherman whose job it is to find the fish and direc the netting. He paddles about, slipping over the side every 50 yards or so With one hand on the gunwale of the craft, and his head a foot or so belo the surface of the water, his body almost vertical, and his legs slowly treadin water, he listens for fish. After half a minute he comes up for a breath, the goes under again; when he is sure that there are no fish there, or they ar too few to make a cast worth while, he climbs into his sampan and moves on

This technique of listening for fish is a striking one; as it may arous scepticism it is worth a brief comment. The art is a skilled one, to be g only by training for several months. At first the novice hears only the soun of the waves; later he begins to distinguish the noises made by shoals or larg fish of different kinds. Here are some of them as described to me by expert An ordinary jewfish (*gĕlamo*, *Otolithus* sp.) makes the noise *bu-bo-bu-b* "like rice frying." Another jewfish, *gĕlamo jarang gigi*, makes a gruntin noise *aup*, *ar*, *ə̃; aup. ar. ə̃*. Another, *gĕlamo rapang*, goes *pūp pāp pūp*; whil





1. Trengganu sailing craft (prahu bĕsar)

2. Fishing boats inside a river mouth

A Fishing for squid with a small brass greatgaf

still another kind, *gĕlamo kuning dada*, the yellow-breasted jewfish, goes *būp*, *bŭp; bŭp bŭp bŭp*. A large herring (*pĕrupok*, *Pellona* sp.) is heard as *chuchat*, *chuchat*; if there are many of them they go *chuchat-chuchat*, "like the twittering of the young of birds." The silver-bream or silver-belly (*kikek*, *Gazza*) goes *yē yē yē*, or if there are many, *roye*, *roye*, *roye*, "not a nice voice" the expert said. Most of these are said to be noises made by the fish as they feed. Others are made as a shoal of small fish moves through the water. Pilchards sound "like the surf on the beach on a quiet night," *ooo up; ooo up*, with a high rising note and then an abrupt fall; sprats are heard as a high-toned hum, *mmmm*, *mmmm*, "like the rustle of casuarina branches in the wind." Other noises again are made by the larger fish. The ray makes the sound *bŏp*, *bŏp* with its mouth as it lies on the bottom, and *bāp*, *bāp* with its fins; "this is a fine noise," the expert said. Some types of fish cannot be heard at all; "they haven't got any voice; they just keep quiet; they don't know how to speak." The experts do not all reproduce these noises in the same way. They tend to specialize in different branches of fishing and so become more skilled in picking out the noises made by the kinds of fish they are most interested in. The point of this identification of fish by sound is that the expert can diagnose whether there are fish in the vicinity, whether they are of the type suited to his net, and from the volume of sound if they are present in large enough numbers to make it worth while for the crew to go to the considerable labour of shooting and hauling the net.

When the expert has located a shoal of satisfactory size he gives a signal with his hand, the two boats come up and begin to pay out their nets. Each makes a half circle, dropping a small wooden triangle as a buoy to mark the beginning of the net. Each boat as it finishes paying out its net picks up the buoy from the other, so making a complete circuit. The crews are large because the boats must paddle round as fast as they can before the fish can escape. When the circle is complete the men beat on floor-boards of the boats, or on bamboo poles held half under water, to frighten the fish into the net. Then the work of hauling the net and picking out the fish begins.

For fishing by night only one boat is used, with a single net. This time a kind of mackerel (*kĕmbong*, *Scomber kanagurta*) or a very similar horse mackerel (*sĕlar gilek*, *Caranx* sp.) are caught. These fish appear in shoals off the coast between March and November, irregularly, but usually for a short period each month. The boats go out when the moon is down, at some late hour in the night or early in the morning. The sound of a buffalo horn summons the crew when the time draws near. They take with them flares, open bamboo tubes full of paraffin, with rolls of sacking as wicks. Each boat has its captain, who is an expert fisherman, but this time he does not have to have to locate the fish, since a shoal is seen as a ruffling white patch on the surface of the water. But a great deal of skill is needed in knowing where the shoals are to be found, and surrounding one with the net. Each boat lights its flare and acts independently. When a shoal is seen the buoy is thrown overboard, with a plume of branches sticking up from it to enable it to be picked up more easily in the dim light, and the management of the net is much the same as before. Conditions are sometimes very difficult in this night fishing. I have heard of seas so rough that boats have had to lash spars

across the gunwales to lessen the rolling, or even to roll up their catch of fish as best they can in the net and put it overboard to let them ride higher in the water.

The boats usually stay out all night and come to shore in the early morning. Before sunrise they creep in with paddles going, unable to use their sails in the face of the land breeze which is bearing out the day fishermen. Some, with nets piled high and a horn blowing, have good catches, others coming quietly in may have little or none, for this type of fishing is very much an affair of skill and luck. A good catch is several thousand fish, or "tails" as they are described by Malays: five thousand is not uncommon, and occasionally about ten thousand may be taken by one boat.

The scene on the beach as the boats come in is one of keen activity. Dealers crowd round and haggle for the fish, at a price per thousand if the catch is of moderate size, in bulk if it is very large. They ask how much. The boat captain mentions a starting price, usually higher than what he is prepared to accept. They bid, and the chaffering goes on till the captain is induced to name a "dead price," that is, either the lowest or very near to the lowest figure he will take. If demand is keen, as it will be at the beginning of the short season each month, the fish are snapped up and rushed off to be sold fresh in the inland markets. If it is sluggish, on a day of heavy catches, or with boats that come in late, or at the end of the season, most of the fish are bought for salting or pickling with spices, to be held against the monsoon period, when fish are scarce. Some of the fish is bought for cash, but most is got on a week's credit, payment to be made on Friday. Prices on the beach are extraordinarily sensitive; they vary not only from day to day but from boat to boat, as the dealers haggle among themselves and calculate margins of profit. They judge what conditions will be like elsewhere on the coast; what demand there will be in the inland markets; what amount of capital they can afford to lay out in fish to keep; what supplies of salt are available; whether the prospects of fish seem good for several days more—and so on. In times of keen demand the fish may fetch twenty-five dollars a thousand; they may fall as low as ten dollars. But with a good catch a net may easily get fifty dollars for a night's work.

The division of the earnings is quite complicated. It is usually done at the end of the week, by the captain. The broad principle is that one-half of the takings goes to the net, and one-half to the boat and crew. The net share is split up among the owners of the various sections, in proportion to the number of sections each man has. The other half is divided according to the work done, the basis being a set of equal shares. The boat owner gets two of these for the use of his boat. Each member of the crew, including the captain, gets one share in virtue of his work in paddling and handling the boat, a "body's share," *bagian tuboh*, as it is called. The captain gets one or two extra shares for his direction of affairs; if the net has been out by day the expert gets one extra share too for listening for the fish. The man who has the often arduous job of keeping the boat baled out gets one extra share too, and so also do the two men who pay out the net and handle it at sea, the "float-handler," *mĕnarang pĕlapom*, and "foot-handler," *mĕnarang kaki*, as they are known. The upshot is that out of takings of say fifty dollars an ordinary crew man

gets about one and a half dollars; if he owns, say, three sections of the net as well he will get about five dollars. The captain, if he owns the boat and about half the sections of the net, gets about eighteen dollars. But though this is the customary scheme various modifications are often made. For instance, in his desire to attract paddlers for more efficient work the captain often reduces his own share and enlarges that of other members of the crew. A portion of the catch is always set aside and divided for the use of the crew. This, called *makan lauk*, is regarded as very important. Not only does it give them fish for food in their families but they sell part of it for cash to buy cigarettes and coffee.

I have analysed this one type of fishing merely as a sample of the intricate organization involved in these joint fishing enterprises. Some types of fishing are even more complicated, and the organization and the principles of sharing the earnings vary from one fishing area to another, all along the Kelantan and Trengganu coast. To master the details needs months of close study. But the general picture is much the same everywhere: the hardness and uncertainty of the fisherman's life; the break in his work caused by the monsoon; the fluctuations in fish prices; his cooperation with his fellows; his complex system of sharing the takings; his use of credit; the way he puts savings back into the industry. The picture as one sees it on that coast is very different from the conventional one of the indolent, thriftless Malay. The fisherman has often a struggle to get food enough for himself and his family. If he has no boat or net capital to help him out his average earnings often amount to no more than about two dollars a week, and out of this he has to save about ten dollars against the slack season of the monsoon.

The coastal people do not engage in much agriculture; most of the men have little time to do so. But some of them and their womenfolk cultivate rice, and some of the men, especially those who are seasonal line fishermen, grow vegetables for the market. About twenty kinds of rice are grown in the Perupok area, some by the so-called dry method, by dibbling in seed with manure; others by transplanting into soft mud, the wet method. In that light sandy soil an interesting fusion of the two methods has been evolved by using thinnings from the dry rice to provide seedlings for the wet transplanting, as an alternative to taking seedlings from a specially prepared bed. On the whole the yield is not high near the coast, and the villages where we were produced only about one-fifth of the amount of rice they consumed. The rest was bought in the local shops or from rice farmers in the plains inland. But the demand for rice land was keen and fragmentation of fields was rather common. The two hundred and twenty-two rice plots I studied were distributed among one hundred and twenty-four owners, and the plots ranged in size from one-tenth of an acre to three-quarters of an acre. If fishermen could not work lands they owned with their families, they let them out on a share-cropping basis to other people who had more time. Wealthy fishermen even had money invested in rice lands to give them a steady income against the day when they might retire.

The vegetable growing gives a very useful cash income, varying between a few dollars and as much as one hundred dollars according to the amount of work put in during the three or four months' season. The main vegetables

grown are pumpkins, melons, cucumbers, aubergines, sweet potatoes, manioc, lady's fingers, cowpeas and other legumes. Some maize, pepper, yams, and tobacco are also cultivated. They are all grown on the drier soils of the ridges, either on fallow land, or as a catch-crop between rice harvest and planting. The land is free in the sense that any owner will give permission for it to be used, getting in return a basket or so of vegetables when the crop is ready. The great item of outlay is labour, needed not only for tilling the soil, but also for collecting the necessary manure, and especially for watering. The vegetable season, between about March and July, is usually fairly dry, and the grower of pumpkins, melons, and tobacco in particular may have to spend many hours a day carrying water.

There are other subsidiary occupations in the coastal region too. In many of the villages women make nets; around Kuala Trengganu they weave silk cloth; a few families make fishing line and others coarse rope for nets and boat work; some of the centres specialize in boat-building; practically every village has its fish-drying and curing; some people have cattle, goats, and sheep, others poultry. A few men climb coconut palms for a livelihood, to collect the nuts for copra-making; others keep and train monkeys to pluck nuts for them. Then there are carpenters, goldsmiths, and Mosque officials. Women make cakes and sweetmeats, or plait mats from pandanus leaf, or sell flowers, fruit, vegetables, or rice in the markets.

There are three points which impress one about the economic life of the region, apart from the main activities of fishing and agriculture. The first is the multiplicity of minor occupations, either whole-time or part-time; nearly everyone tries by some subsidiary work to eke out his income. "How otherwise can we get a living?" they ask. The second point is the great number of petty dealers working on small margins: fish, fruit, vegetables, and cloth, all have several middlemen passing on the commodity from producer to consumer. This is one of the characteristic features of a small-scale peasant economy. The third point, more noticeable in Kelantan and Trengganu than in most other parts of Malaya, is the great role of the women in this petty trade. Many of them make a substantial contribution to the family income in this way, and some support themselves entirely.

But the life of the people is not just a round of work. They have their sports and their ceremonies. Bull-fights, officially sponsored, draw large crowds, and the qualities of a champion fighting bull are discussed much as are those of a football star in this country. *Wayang kulit*, the shadow play, with puppets cut in fine patterns out of cowhide; *main bĕrsilat*, a kind of formalized wrestling; *main bĕrdikir*, a ceremonial chanting of verses of the Koran; *main pĕtri*, a performance to heal the sick, with a *bomor*, a medicine man or spirit doctor, and a spirit medium—these are dramatic spectacles, each with an orchestra, attracting the village crowds. They are not very frequent in the coastal region, because the cost of the orchestra and of feeding the performers is a heavy one; it may well amount to twenty or thirty dollars for two or three nights' entertainment. But every now and again some family, whether from solicitude for a sick person, or wishing to celebrate an occasion, arranges for a show to be held, often getting performers from some distance. They are all fascinating from the artistic point of view. The shadow play, a

5. Preparing to take fish to market

6. Making fishing line

7. Fishermen's houses near Melawi, Kelantan

8. A corner of an inland market

9. A fighting bull in the ring at Pasir Puteh, Kelantan

kind of prototype of the cinema, and the spirit-healing performance, with its ritual dancing, are especially interesting to the student of religion and magic. Then there are the social occasions, such as weddings and circumcision ceremonies, each with its procession and feast, to which relatives, neighbours, and friends are formally invited, and to which they must come with gifts of rice and cash. The finance of these affairs, with its elaborate credits and repayments, is complicated, and is almost as much a matter of interest as the feast itself. The great questions the day after, around the village, are "How much did the host make?" and "What is he going to do with the money?"

There are other smaller scale ceremonies too, regulated by the Moslem calendar: *Hari Raya Poso*, the end of Ramadan, the month's fast, when fine clothes are worn and every family makes presents of the rice sweetmeats known as *kětupat* to their friends; *Hari Raya Haji*, the celebration of the high point of the annual pilgrimage in Mecca, when cattle and goats are killed, and neighbours, friends, and religious teachers are invited to meals; *Suro* (*Ashura*), the celebration of an incident in the life of the Prophet (when he had to make a meal from scraps) by cooking in a large iron cauldron a rice porridge compounded with chicken meat and spices, and sharing it among the people who bring raw materials and take part in the work. One of the most dramatic ceremonies is the *gĕrbang* (*kurbān*, sacrifice), with its ritual killing of bull or cow, followed by gifts of the meat to friends and by ceremonial meals. The bull is usually bought by subscription from several people, and the price must be made up in seven shares. A person can take up one, two, or more shares, but the total number must always be seven. The transfer of the bull to the purchasers is a formal matter, each partner taking the halter rope in his or her hand and affirming that he is buying it according to legal form. The slaughter takes place ritually, under a white prayer-cloth, and the meat is then cut up for distribution. The local interpretation of the *gĕrbang* is that over a period of years a person gradually accumulates a complete set of seven shares in an animal. He has then sacrificed a whole bull, as it were. Then on the Day of Judgement, when all the Faithful appear in procession before Tuhan Allah, the Lord, he can appear in the parade, riding his bull. For this reason the animals selected for killing are of good size and appearance. I asked one old man if goats or fowls were never killed for the *gĕrbang*. He answered with some scorn, "No. How could a man appear on the Last Day before Tuhan Allah riding a goat or a cock?" If a man is wealthy he can buy a whole bull outright, or take shares for his children to give them a credit balance, as it were. But most of the fishermen can afford only one share, and not that each year, so the system is an ingenious method of enabling a poor community to fulfill its ritual obligations.

This brief account has had to pass over many important phases of the social and economic life of this interesting peasant people. But it may give some idea of their surroundings, their character, their industry, their standard of life, and the cultural values which bind them together as a community. It may also show that in any programmes of reconstruction and development of Malaya after the war the peasants of the East Coast should not be forgotten. They are an integral factor in the economy of the country and are worthy of technical and economic assistance in improving their conditions.

NOTES ON THE ILLUSTRATIONS

1. *Trengganu sailing craft* (*prahu bĕsar*)

These vessels, seen here in Kuala Trengganu, are locally built by Malay craftsmen. They are owned by Chinese or Malays, and carry rice, salt, and other cargoes along the coasts of Siam and Malaya. Large craft of this type measure about 80 feet from stem to stern, and cost several thousand dollars to build. The forward rake of the masts is typical of the Trengganu style.

2. *Fishing boats inside a river mouth*

This concentration of boats is at Kuala Kemaman, South Trengganu. The bold headland on the north side of the river mouth and the low sandy point on the south side are typical of the harbours on this east coast. In the quiet waters of the estuary some boats are made fast to stakes and left afloat whereas on the open ocean beaches they would be all drawn up. The small craft in the immediate foreground are used within the harbour; the larger craft in the background (of various types, as shown by differences in shape of bow and stern) are used for net-work at sea.

3. *An expert fisherman in shore dress*

The *jurusĕlam* Awang Lung of Pantai Damat, Kelantan, is standing proudly beside his boat. At sea, instead of his black velvet cap (the Malay man's national headgear) and light clothes, he wears a pandanus leaf sun-hat and garments of heavy cloth. The carved crotch at the bow of the boat holds mast and spars when they have been unshipped.

4. *Fishing for squid with a small brass grapnel*

The fisherman is waiting with the line over his finger to feel the gentle tug as the squid grasps the bait; with a sharp jerk he then catches it on the grapnel and swiftly hauls it to the surface. Part of his catch already lies in front of him. At his back is the heavy stearing oar. The rectangular box holds fishing lines and materials for smoking and chewing betel; the round box holds cooked rice and other food. The photograph was taken in the early morning, about 8 miles off the Kelantan coast.

5. *Preparing to take fish to market*

The fish are put in these large baskets for carriage by motor buses to the inland towns and villages, where they are sold to retail dealers. In this case the fishermen are loading the catch themselves, since they have failed as yet to come to an agreement with the wholesale dealers on the beach.

6. *Making fishing line*

The village of Losong near Kuala Trengganu is a centre for this work. The cord is twined from cotton thread, with simple equipment, of which the main items are two large wooden wheels. One of these is shown at the left of the picture. Both men and women take part in the work; the woman is here coiling up a finished line.

7. *Fishermen's houses near Melawi, Kelantan*

Built among the coconut palms immediately above the beach, the houses are protected from the north-east monsoon by high wind-breaks. The photograph was taken in September, shortly before the screen was renewed against the coming monsoon. The house in full view, built of plaited split bamboo and poles, with a roof of *atap* thatch, is a typical ordinary fisherman's home. The concrete well-head near the left of the picture is a common Kelantan feature.

A corner of an inland market

At this market, in Manir, a village a few miles from Kuala Trengganu, cloth, dried fish, fruit, vegetables, sugar cane, sweetmeats, and baskets are commonly sold; people also come from the coast at Batu Rakit to sell or exchange fresh fish for vegetables. Here as elsewhere in Kelantan and Trengganu women play a great part as retail traders.

A fighting bull in the ring at Pasir Puteh, Kelantan

The animal is of a common Eastern humped type. His horns have been smeared before the fight with a magic ointment to give him strength; the umbrella and the paper caps are intended to prevent this from being washed off by the rain which had begun to fall.

DISCUSSION

Before the paper the PRESIDENT (The Rt. Hon. Sir GEORGE CLERK) said: Dr. Raymond Firth, an anthropologist by profession and a member of the staff of the London School of Economics, went a few years ago to study the agriculture and the fishing economy of the peasant people of Malaya. He selected an area on the East Coast as less affected by European and Chinese influence, and to-night he is going to speak to us of the coastal people of Kelantan and Trengganu.

Dr. Firth then delivered the lecture printed above.

The PRESIDENT: I am sure you all agree that we have had a most interesting and entertaining evening. I was particularly interested to find how fishermen resemble one another the world over. I could parallel much of what Dr. Firth has told us by citing Grecian and Turkish fishermen on the Sea of Marmora. They use the same implements and have almost the same way of attracting the fish, but I do not think I could have found either a Greek or a Turk who listened to fish. Otherwise all fishermen are the same.

We hope, whatever may be the fate of the people of Kelantan and Trengganu at this time, that when the time comes to help them reconstruct their lives we shall, as Dr. Firth said, bear in mind the work of anthropologists like himself who study these people as they are and get to know them in their lives and who can, no doubt, guide those who have to look after their welfare so that they can really help these people. In their work Dr. Firth and others are preparing the way for the future and it is to be hoped that their great work will meet its reward. It only remains for me to express your thanks to our lecturer.

THE JAZ MURIAN DEPRESSION, PERSIAN BALUCHISTAN

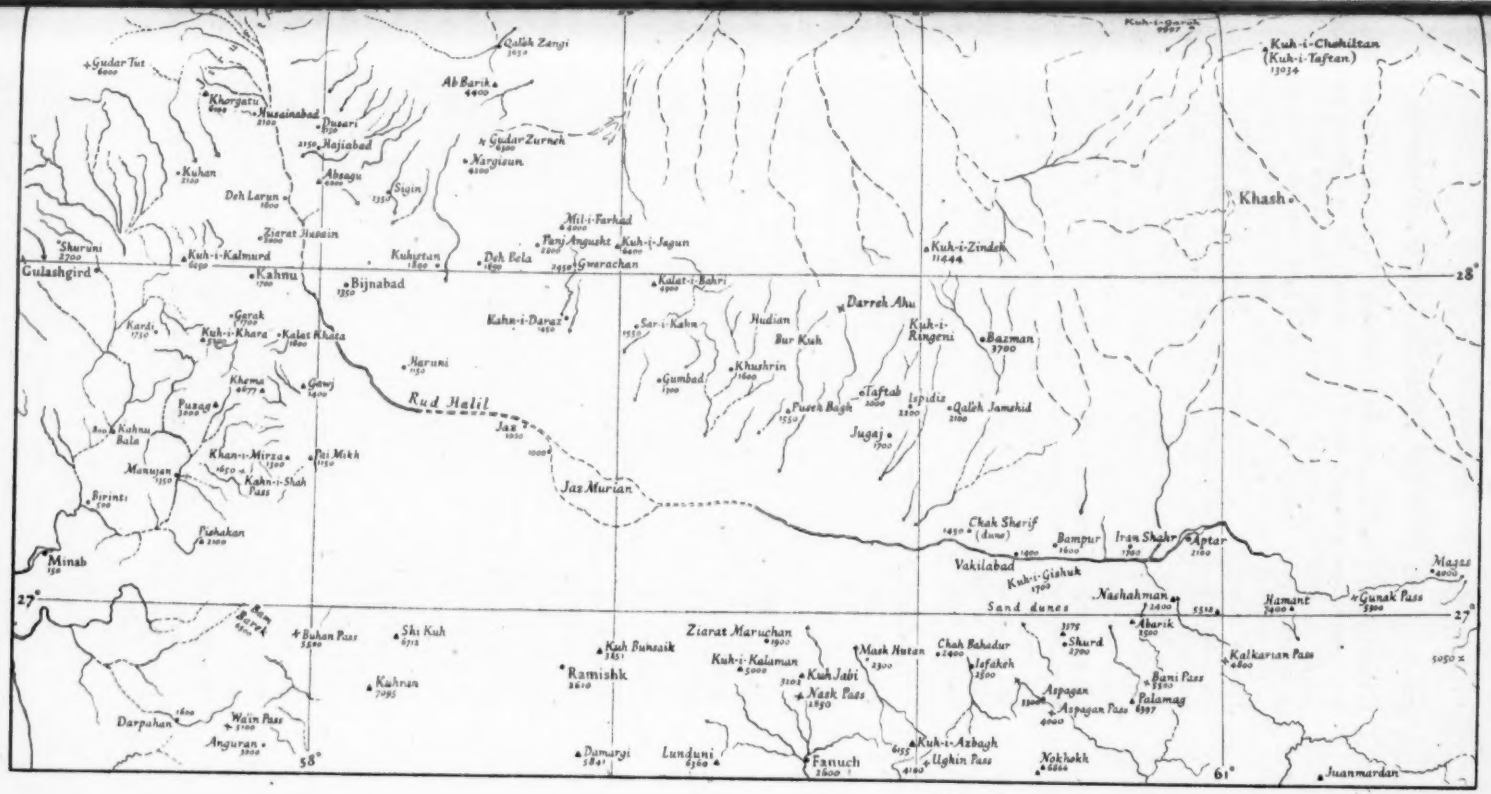
J. V. HARRISON

Meeting of the Society, 3 May 1943

A STRIKING feature in most of Western and Central Asia is the number of enclosed basins with no drainage outlet to the sea. They are found in Turkey, Syria, Palestine, Transjordan, Arabia, 'Iraq, Persia, Russia, Afghanistan, Tibet, and China, and occur at many heights from 1300 feet below sea-level to 16,000 feet above it. A variety of accidents affecting the crust of the earth have caused them such as folding, or faulting, or rarely volcanic eruption. The conditions within them vary according to the climate and the composition of the rocks exposed over their floor and sides so that fresh-water lakes, salt-water lakes, swamps, salt-swamps, or salt-deserts may occupy their central part. They have at least one feature in common which is that they develop in regions where the rainfall is low and the accumulation of water is unable to make headway against its removal by evaporation and seepage. Where the rainfall is heavy enough to keep adding to the reserves of water in a basin it will ultimately fill up and overflow. The stream then cuts a breach in the rim of the basin and as this becomes lower as the erosion goes on, the stored water is drained off, and a valley is formed instead of the basin.

More than half the Kingdom of Persia is covered by enclosed basins, even if the Caspian Sea which is the lowest part of a prodigious enclosed basin itself, be regarded as a sea proper. The northernmost is lake Urmia, an extensive salt-water lake. A group of basins in Central and Eastern Persia form the dangerous wilderness known as the Lut. This includes some twelve individuals. Three in the west of the central part contain shallow salt-water lakes north and north-east of Qum. The Great Kavir and satellite basins in the north extend nearly 300 miles to the east of Qum; they are occasionally flooded, but usually display a harsh veneer of salt crystals, buckled and brecciated in places, furrowed by dangerous channels of treacherous slime. The oval-shaped perilous desert of the southern Lut lies south of the Kavir; a basin 250 miles long from north to south and 150 miles wide. It holds a narrow elongated salt-crusted sump at the lowest part about 1000 feet above sea-level, with a girdle of desert whose surface is diversified by wind-controlled and stream-lined palisades of banded silts confining great desolate boulevards running north-north-west. All these basins are relics of greater or former lakes now partly or completely dried up. All of them have some area of sump which is extremely salt, and they all exhibit more or less well-preserved terraces at points around their sides. In some of them rough hills of rock stick out of the salt crust like islets from the waters of an estuary; in others the shores are surprisingly straight and no stacks project in front of them. The main lines of the mountain chains skirt them discreetly and do not seem to have very close interrelationship.

The southern wall of the Lut stands about 12,000 feet above sea-level south-west of the once important fortress and adjoining town of Bam, but it


Kuh-i-Garuk 9907
Kuh-i-Chahiltan (Kuh-i-Taftan) 13034
Khash
Qalih Zangi 3650
Ab Barik 4400
Gudar Tut 6000
Khargatu 6000
Husainabad 2100
Dusari 850
Hajiabad 2150
Gudar Zurneh 6300
Nargisun 6100
Kuhan 2100
Absagu 6000
Sigin 1350
Deh Larun 1800
Ziarat Hussain 2000
Shuruni 2700
Kuh-i-Kalmurd 6250
Kuhistan 1800
Deh Bela 1400
Mil-i-Farhad 6000
Panj Angusht 6200
Kuh-i-Jagun 6600
Gwarachan 7450
Kuh-i-Zindeh 11444
Gulashgird
Kahnu 1700
Bijnabad 1350
Kalat-i-Bahri 4900
Darreh Ahu
Kuh-i-Ringeni
Bazman 3700
Kuh-i-Kharo 5300
Kalat Khaza 1800
Kahn-i-Daraz 1450
Sar-i-Kahn 1510
Hudian
Bur Kuh
Gumbad 1900
Khushrin 1600
Taftab 2000
Isputiz 2200
Qalih Jamshid 2100
Jugaj 1700
Kardi 1710
Garak 1700
Naruni 750
Khema 4677
Gawj 1400
Rud Halil
Jaz 1830
Jaz Murian
Puzag 3000
Kahnu Bala 800
Khan-i-Mirza 1300
Pai Mikh 1150
Manujan 1650
Kahn-i-Shah Pass 1350
Birinti 700
Pishakan 2100
Minab 150
Chak Sherif (dune) 1450
Bampur 1600
Iran Shahr 1500
Aptar 2100
Vakilabad 1400
Kuh-i-Gishuk 1700
Nashahman 2400
Sand dunes
Hamant 2400
Gunak Pass 3300
Mazes 4000
Kuh Burk 6800
Buhan Pass 5280
Shi Kuh 6712
Kuh Bunsaik 2451
Ziarat Maruchan 1900
Ramishk 2610
Kuh-i-Kalaman 5000
Kuh Jabi 5202
Nask Pass 2850
Mask Hutan 2300
Chah Bahadur 2400
Isfakeh 2500
Shurd 2700
Abarik 2500
Kalkarian Pass 4800
Kuhran 7095
Darpahan 1600
Wain Pass 3100
Anguran 3900
Damargi 5841
Lunduni 6560
Fanuch 2600
Kuh-i-Azbagh 6135
Ughin Pass 4180
Aspagan 6000
Aspagan Pass 6397
Palamag
Bani Pass 5350
Nokhokh 6866
Juanmardian
5050 x
28°
27°
58°
61°

is traversed by passes of 6000–8000 feet high. Farther east the range is muc less conspicuous although the divide continues across a rough wild countr and keeps generally eastwards for about 160 miles. A few passes at just ove 4000 feet allow of transit over a jumble of hills presenting a strong contra to the ordered system of parallel ridges which is so conspicuous in mo Persian mountains. A large dormant volcano, Kuh-i-Zindeh, 11,000 fe high, commands a comprehensive prospect of this hilly disorder. South o the divide the hills soon die away and all rocks disappear under a sheet o debris and silt about 180 miles long from east to west and roughly 60 mile broad. This is the Jaz Murian depression. Its centre stands approximatel 1000 feet above sea-level and it is dry for most of an average year. The si left behind in the sump is fresh enough for cultivation, and when it is floode after rainstorms in wet years grass grows on its very gently rising shore aroun the temporary lake that gathers. Cattle wallow in it far from the shore-lin and when at length it dries up, wells sunk here and there near the stran provide a few families with drinkable water. Compared with any othe Persian basin its water and the silt it leaves behind are notably free fro salt.

The southern divide of the depression stands mainly above 4000 feet excep for a low gentle pass north of Fanuch where there is an entry no higher tha 2850 feet above sea-level.[1] The range on this side is generally a simple hig chain parallel to the edge of the basin. The watershed in the east has rathe greater elevation and shows the same structure except that here the directio of the ranges changes, on the north they are aligned boldly north-north-wes with the wild peak of Hamant, like the coulter of a plough, shearing ther apart from the east and west ridges on the south. The two trends becom parallel by bending just before they enter British Baluchistan to the east.

The west presents a totally different picture. The divide falls as low a 1650 feet above sea-level, and at two points is almost imperceptible on wid sheets of gravel fans discharged from watercourses farther west. In thi direction all trace of a well-formed and clearly directed mountain chain i lost, and in its place there are blocks of weather-worn plateau, interspers amongst sheets of gravel and separated from them by approximately straigh lines. The plateau top may stand at 2000 feet or more above the plain, an its edge may be steeply bevelled off, even if somewhat fretted by later erosion In one place a fragment of the old plain which existed before these blocks too their present shape is still visible as clearly as that on the Atlantic seaboard o the New England States. But it is also tilted. One other unusual point is tha the watercourses cross these elevated rock masses in deep gorges which ma be termed canyons. In spite of the fact that they are now generally dry, an although they are often deep, they have a floor which falls at a gentle gradien and is well covered with gravel. It is also noteworthy that the streams cros the gravel sheets outside the great rock slabs in nearly parallel lines until clos to the next rock mass to the east when a few may unite, and then, instead o being deflected around the nose of some elevated rocky block, cut righ through it and form a gorge. Even then the stream gradient does not chang

[1] For the country south of Fanuch see map of "Coastal Makran." J. V. Harriso *Geogr. J.* 97 (1941) 5.

ppreciably whether it be in a rocky channel or crossing the gravel sheet utside.

These are the general features of the Jaz Murian depression which it was y task to study, during the winter season of 1935–36 when the Anglo-anian Oil Company, despatched a party to the region consisting of myself d Messrs. Allison, Falcon, Hunt, McColl, and Maling. I was fortunate ough to make three flights over the basin, two before, and one after the urneys on foot. During the expedition a rough geological map was made tending and amending earlier ones produced by Messrs. Blandford and ipper. There was also an opportunity to take many photographs so as to rnish a pictorial record of parts of the Jaz Murian and to survey districts completely known.

Several travellers have visited the district, but apart from Sir Percy Sykes, robably no one has seen so many parts of it as we did. The Keep at Bampur as for long the centre of gravity to which Europeans who visited the basin ere attracted from the time of Grant and Pottinger at the beginning of the ineteenth century. The prolonged discussions concerning the Persian, aluch, and Afghan boundaries, and the commissions which visited eastern ersia until about 1905 to demarcate these, were responsible for a large umber of visitors some of whom left clear objective diaries. Floyer showed are initiative and able literary ability when he travelled from the south-west the depression in 1881. Blandford and Tipper looked at different sections f the depression with shrewd geological eyes, and Gabriel brought no mean otanical and ethnological learning to bear on parts of it. His journey in 928 provided the only exact knowledge, collected in the immediate vicinity, f the modern shore-line conditions of the central area which is flooded in inter. The keen political interest in and acute nervousness over this Makran egion until about 1909 was responsible for the visits of various survey parties hose work has resulted in maps which are far superior to those of most of he rest of Central and Southern Persia. In 1934 Sir Aurel Stein travelled long its fringe during his archaeological traverse of Persia.

But the basin has been known for a long time. Alexander and part of his rmy are believed to have crossed its northern slopes on the way back to the est from India, and Marco Polo did not complete his Asiatic wanderings ithout seeing something of it. The western stretch of the southern side is he least known part. Sir Percy Sykes alone among Europeans has visited it, nd his description is all too brief. It was turbulent then; it is turbulent now. I have viewed this sector only from the air and from hill tops at the eastern nd western ends, but I can affirm that the zone shows no unexpected topo-graphical change from the country near Mask Hutan which adjoins it to the ast. A short account of our journey is given below to provide a picture of the asin, and to state some of the facts from which a few speculations regarding he origin of the Jaz Murian depression may be pursued.

Our camel caravan assembled at Bam on the south-western side of the outhern Lut and took six days to reach Gudar Zurneh, the pass at 6300 feet, ver which it crossed the divide and entered the basin of the Jaz Murian. The round drops considerably along the trail just south-east of Bam, and several *anats*, in good preservation, tap the water supplies held in the debris along

the northern foot of the mountains and bring it to the surface near the ro to irrigate the date and henna gardens of Borah. After one day's journe south-east the track starts to rise again and climbs the gentle glacis risi southwards towards Jebel Bariz. It passes the old and crumbling fort Qal'eh Zangi, where a ruin stands like a pulpit above the pews, not far fro the mouth of a considerable watercourse draining a substantial area of t mountains to the west. Water flows over its broad surface only spasmodicall after rare storms in winter, though what percolates through its gravel forms valuable quota to the water supplies of Narmashir. Its walls are cut into t glacis, exposing sands and gravels, and a low fan of debris has spread out, though embossed on the plains which fall gently to the north until they merg into the haze or the distant horizon.

Some miles to the south of this district the glacis gives place to a series fine terraces arranged at heights of 70, 150, 250, 400, and 600 feet respectivel above the bed of the present stream. They are cut across the tilted beds conglomerates and sands which lie against the granite core of Jebel Bariz, an occasional sugar-loaf mountain outside it where a volcanic throat w located. Hot springs escape at a few places. One of them is used as a medicin bath by the folk of Bam. Others have dried up and left little cones of lim stone akin to the stalagmite deposits of the dropping well near Knaresborough Hot springs are common throughout western Asia and are often interpret as indicating an active fracture where subsidence of a basin has occurred an may recur with earthquake shocks.

The higher ground of Jebel Bariz is not bare like the plains towards th Lut, but is dotted at first with many little bushes, and higher up with tre as well, until the thin cover of vegetation might almost pass for verdure, least in this part of the world. Few people were found here in October, b in the early summer Gabriel found that tribal people from Narmashir in t south of the Lut come in numbers with their flocks and live under the trees perhaps in a tent, subsisting principally on milk from their animals, for the is nothing except grazing to be got here, unless for a few weeks when t berries are ripe. Scrub persists as a patchwork on the descent to the sout thin on the spurs, but amounting almost to jungle on the wide sweeps gravel which are distributed by the drainage from the highlands. Thoug water is seldom found flowing at the surface, it is easily obtained in suc places by making shallow holes in the gravel, and even in autumn, the dri time of the year in most of Persia, families live upon these gravel tongu which keep up their supply of water and sustain the cloak of vegetation whic hides them. They are furtive people, suspicious of strangers and eas alarmed.

The approach to the plain from Gudar Zurneh is mostly hidden by a ki of loosely laid, giant crazy pavement of flat-topped hills vaguely recalli kopjes on the High Veldt. The almost horizontal layers of the strata co posing them can be seen in their steep sides. Fingers and tongues of silt, t alluvium of the plains, feel out between them and are dotted with clumps the low bushes known to the botanically uninformed as "camel thorn," whi in a few places considerable plantations of date palms rise near the foot of t slopes wherever qanats or wells provide them with adequate water. T

Terraces looking south from Kahn-i-Daraz

Jaz Murian looking north from Kahn-i-Mirza with three "dust devils"

Four miles south-east of Borah: many qanats in distance

Satellite basin near Kahnu showing rock waste, fertile strip, and sterile cent

Five terraces on the north side of Jebel Bariz, east of Ab Barik

people who cultivate these groves live in small groups of mat-covered huts close to their gardens. Some 40 miles to the west of Gudar Zurneh the flat-topped foothills give way to a broad tongue of plain probing into the north-west corner of the depression along the banks of the Halil Rud. A few outliers of the crazy pavement still remain, occasionally forming bold hills. Their tops are no longer flat but are tilted to the east. The northern one is white-topped and overlooks the fort of Dusari which stands guard over the corn- and bean-fields on the left bank of the Halil Rud in part of the relatively fertile Iruft district. The southern one has a black lava top and seems to serve as a sign, arresting the eastward tendency of the Halil Rud, forcing it south for a time till it is close to Kahnu before allowing it to turn east again. Farther west, well back from the river, rolling gravelly wastes form low hills and rise somewhat above the strips of steppe which predominate in this district between the straight-sided slabs of worn down plateau made up of solid ancient resistant rock, often looking almost black, but occasionally streaked with bands of white marble.

It is worth while spending a few moments to describe the watershed in the triangular district with Dusari and Kahnu at its eastern corners and with Gulashgird at the western. The Halil Rud has a broad bed about a dozen feet below its banks which are sometimes fringed with rushes, and usually support a strip where acacias and tamarisk trees are numerous and grow to considerable size. Their density and dimensions decrease rapidly away from the river, which in autumn is only a disconnected string of water holes. South-west of Dusari the plain rises gently to an imperceptible divide on gravel slopes near Buduk at about 2000 feet above sea-level. North-east of this the streams from the north-west flow on and join the Halil Rud when they are in flood and so empty into the Jaz Murian. South-west of it parallel streams from the north-west turn away south-west and a parcel of them unite into a watercourse which cuts across the western nose of the big rock tableland between Kahnu and Gulashgird instead of skirting it about a mile to the west. Near Kahnu itself a local swelling of the plain shuts in a satellite basin to the west of the Jaz Murian. It is only a few miles wide and about a dozen long, but it provides an object-lesson in the anatomy of enclosed basins. Its whole surface can be viewed from a neighbouring plateau and displays an outer ring of rock debris about a mile wide only sparsely dotted with small bushes. Then comes a narrow band where the moisture from the walls slowly oozes out, in response to which vegetation, even although it is still scrub, flourishes thickly. Within it there is an almost naked oval central part, subject to flooding in winter but parched dry in summer. Only a few grasses can cling on under the alternate extremes of submersion and drought. The divide between this subsidiary basin and the drainage to the Gulf of 'Oman is formed by an open low pass at about 1750 feet near Kardi, a little south of the Kahnu–Gulashgird line. South of it there is a wide plain of rock collecting any run-off for the Birinti river. The course of this river in its middle part is notable for its impartially even gradient whether it flows over a gravel plain or flows through a channel in the naked rock. For a while its valley is wide and flat-bottomed, but at Birinti this aspect changes. The walls rise and converge, and for a few miles the river keeps to a gorge. One other gorge lies between this and the

coastal plain near Minab, beyond which the water is dispersed through irrigation channels or else runs to the sea.

The rest of the western end of the Jaz Murian basin to the south of Kahnu and Gulashgird is a repetition of the slabs of rocky plateau cut into blocks by straight lines separated from one another by channels strewn with outwash. A conspicuous block in the system is that between Kahnu and Khan-i-Mirza with venerable schists and gabbros ending abruptly on the east for more than 30 miles along a nearly straight line. Its massive and rather smooth slopes are brought into contact with the plain itself or with a fringe of rough spiky hills so steep that some of their faces are not easy to climb. On the west, and only 10 miles away, two narrow fingers of alluvium run north and south respectively until they all but join behind it. They separate this slab from the next to the west. The boundaries of the various blocks, probably faults, run mainly north and south or north-east and south-west, but there is a less usual direction aligned north-west. The intersection of pairs of these produce dice-shaped bodies.

The divide near Khan-i-Mirza is set in undulating country where the rocks crop out generously. It stands at about 1650 feet above sea-level. There is no principal col to which a ridge dips conspicuously, but rather a belt of low country where the watershed is an even ridge rising at length to higher spurs on north and south. It may be recalled that the centre of the Jaz Murian is only 650 feet lower than this south-western divide, and the edge of the plain in this corner is only 400 feet below the crossing to the seaward drainage.

The country is sparsely populated. There are a few villages like Dusari and Kahnu built in proximity to the fort with perhaps a hundred or so people, but otherwise half a dozen huts together is about as many as are normally found. Most of the cultivation is close to the river or one of the qanat systems and elsewhere the people seem to depend for a living almost entirely upon small flocks of goats and sheep. In the basin of the Birinti river the population is slightly denser with a few small villages along the course of the stream, and other small communities, each consisting of only a few huts hidden amongst the scrub on the tongues of gravels issuing from the gorges through the plateau masses to the west. Manujan in the south is a ruined fort which once had some importance as a sentinel guarding the western grazing lands from the raids of the wild men who lived in Bashagird amongst the harsher, higher, and less accessible mountains to the south.

The main rectangular expanse of the Jaz Murian plain lies to the east. Dr. Gabriel has journeyed into the centre of this. He found a sparse unfriendly population living amidst stubble-fields of the last year's harvest, and he saw signs of other fields which he thought had once been more extensive. The strand-line of the last year's flooding was plain and so were the trails preserved in its hardened mud made by cattle and donkeys. The tufts of dead grass he found he explained as killed by floods. He drank well water though he says it tasted badly.

Our journey kept us nearer the edge where rocks were not so far off. On the west the plain runs up towards the straight boundary of the plateau country, but before it gets there numbers of sharp pyramids break the surface. In form, though not in colour or setting, they look like the Needles off the

Isle of Wight, but they are assembled in numbers as if forming a nightmare archipelago. Their elaborate pattern on the plain affords a striking contrast to the straight line on the west across which neither such stacks nor the plain can encroach.

East of Kahnu, beyond the green line of the Halil Rud, stands Bijnabad, one of the few larger settlements right out on the plain. It is almost 50 miles west-north-west of the western end of the floodable patch of the basin and nearly 500 feet higher than it. Gabriel started from here on his visit to the lake. We found that its silty terrain is by no means barren, but is dotted with bushes of camel-thorn, and its general flatness is relieved by small mounds of soil which collect around the stems of the bushes apparently because of the shelter they afford to dust driven on by the wind. Tribal people from the north come here with their flocks to winter, and their goats and sheep seem to thrive upon the unappetizing-looking flora just as camels may do. Here and there small sand-dunes have been piled up on the silt floor, but most of them are stationary, carrying plants and grasses upon their backs. None of the bare sickle-shaped travelling kind was seen. Nearer the northern edge gravel from the surrounding mountains has been swept in as a thin veneer on the surface of the silt, resulting in the disappearance of vegetation. The sparse population is also banished except in a few select spots where a ridge breaks the flatness, or a depression, gouged out by a watercourse from the north, brings water within reach of the surface. The glacis usurps the scenery for many miles during travel across this northern terrain and most of it is sterile desert.

Farther north, where the main ridge of the Jebel Bariz dies away 20 miles south-east of Gudar Zurneh, the divide carries on along a devious line through surprisingly irregular country. The ridges and valleys conform to no detectable pattern, but twist about. They depend for their arrangement upon the erratic foundations of a cluster of old volcanic cones long since ruined by erosion. Some of the features encountered are arresting landmarks such as the sculptured columns along an escarpment, known as Panj Angusht. Another is formed by the tremendous cone of Mil-i-Farhad. It is very similar in appearance to Ailsa Craig in the Firth of Clyde, though this Persian monolith is loftier and stouter, rising as it does 2500 feet above the surrounding terrace with a girth of approximately three miles. As Tipper has already recounted, its constitution is not so very different from that of Paddy's Milestone. An immediate contrast to this chaos of forms is afforded nearby where some patches of nearly flat plateau are preserved along the general line of the divide. An explanation for them can be found easily, for most of this area in very late geological times was overwhelmed by sheets of lava on a large scale, and while these sheets do not seem to have been very robust they were thick enough and stout enough to withstand the tooth of erosion in places and to have held up big platforms of lava-capped surfaces. Farther east near Bur Kuh the lava did not form a tableland but is like a black enamel poured over features already formed. The forlorn scenery that is made by the combination of the young and older volcanics is not ameliorated by a genial population, for this, though it is very scanty is also rather hostile to strangers. About the only amenities this wilderness affords are a trickle of water and grazing that looks unpromising to the unexpert eye of a foreigner

who can think in terms of Irish and Devonshire pastures. Near Hudian there are some large date gardens as well; here Gabriel found himself so unwelcome that he had to hasten his going even when he was far from well.

After 50 miles of this jumble the prospect changes abruptly just south-east of Hudian. This is caused by the steep-sided mass of limestone highlands called Bur Kuh where the chancy mixture of hard and soft beds inherent to the roots of a volcano is replaced by the fairly regular sequence of sheet upon sheet of limestone. A large fracture lies between the two terrains, and indeed the Bur Kuh massif is bounded on all sides by faults which bring the young volcanics against the aged limestones, for these are contemporaneous with our British coal deposits whilst the eruptives are much younger than our chalk. A little farther east the limestones have been subject to upheaval at a much earlier period when volcanic outbursts inserted granites amongst them. Bur Kuh is a knot of hills of no great height and fairly even tops limited on the south and west by rather straight lines which have resulted from the network of faults. Between the hills and the plain there is an ample apron of high terrace cut through by gullies 150–200 feet deep. These stream beds are generally dry and available water lies outside the terrace, so that every day we had to journey 3 or 4 miles from camp to reach our rocky objectives and as many back usually over rough going that could only be negotiated on foot. A few goats might find their fodder on these benches or terraces, but camel grazing had to be sought beyond them. In this district the days would pass with seldom even a goat-herd to be seen. Gabriel travelled on the north side of Bur Kuh which he was close enough to photograph, and had to negotiate the same sort of rough country we found west of that massif before he reached and climbed the big dormant volcano, Kuh-i-Zindeh. It seems improbable that this hefty cone which we kept in view for a time, has been built up around the orifice from which the plateau-building lava of the Mil-i-Farhad district emerged. This probably issued from a throat farther west and a little older than this sub-recent pile.

Once away from the hills the caravan can move in any direction it chooses and it is remarkable how often it comes to a well. Every watercourse carries ample scrub, and nearing the Bampur river, some fairly large trees beside. Ridges of sand-dunes have been piled up to a height of about 25 feet above the silt floor, and they extend from close to the river. In December 1935 the river bed held little water, just a series of pools connected by a trickle. Such cultivation as is done seems to be on a small scale but is made possible by irrigation ditches leading from the river. This is the country through which Alexander's army is reputed to have gone. Nowadays the district would be taxed to feed a battalion for long let alone a brigade, and even fifty years ago the route to Kerman across the north of the Jaz Murian had to be furnished with dumps of fodder and grain to enable horses to make the passage. Close to Bampur there is much more husbandry, and as much land is cultivated as the small population living near the old fort can look after. The famous mud-walled fort, itself standing upon a tumulus, is ruined and abandoned, but in 1935 it contained one museum piece, an old brass cannon inscribed with the mark of the East India Company dated 1807.

The scenery just east of Bampur begins to show that characteristic featu

Mil-i-Farhad from the north

Lava-capped hills near Mil-i-Farhad at Gwarachan

Core of Hamant block in the Nashahman valley

Panj Angusht escarpment with columnar structure, seen from the south-east

th-east

of most of south-west Persia, namely the effect of a regimentation or well-marked grain in the distribution of the strata. This is not the case along the west or north of the Jaz Murian, but near Bampur a chain, formed by many parallel ridges, runs away to the north-west from a little north-east of the village. The lowlands on its south-west side form an easy corridor to Bazman village, and affords a route now followed by a passable motor track to Narmashir. The range makes a prong which dies out south-eastwards into the plain of the Jaz Murian while one of the larger tributaries of the Bampur river flows south along its north-eastern side. It is on the gravels of this before it turns sharply west, that Iran Shahr stands. This centre of administration was formerly known as Fehraj, and a fort and telegraph office alone distinguish it from many another village of this eastern corner of the depression. Sir Percy Sykes has described this quarter and the easy march to Magas in contrast to the trying scramble he found the ascent of Hamant, the highest peak in the district, to be. Magas is noteworthy in the present discussion on account of the easy outlet it guards to the east, provided by the remarkable swing in direction of the ranges. Kuh-i-Birg, north of Magas, is aligned north-west, but then it turns and east of Magas runs east. This change in direction is unexpected whether looked at from the north or east, for in both directions the trend is away from Magas. Kuh-i-Birg and its neighbours as far north as Birjand on the one hand, and the ranges along the southern wall of the Jaz Murian depression on the other, form the throat of a funnel with its shank at Magas. The regular east and west ridges of British Baluchistan seem to sheer off in front of Hamant around which a zone of confused hills exists where their sharp ridges lack any dominant direction. A little to the south, near Sarbaz, they pick it up again and follow an east and west orientation.

The core, of which Hamant is the outstanding peak, lies north and west of Sarbaz where deep valleys with wide floors of gravel wander among many ridges with some very bold peaks. Nor is the form of the ridges alone the striking feature, for colours of many hues are to be found changing suddenly with some alteration of the rock. They predominate in a broad band along the south-eastern edge of the plain, at least as far as two days' march west of Tasht Hutan. The watershed is usually found on an upland skirting the core. Near Sarbaz it keeps to a plateau made up of bare dark olive grey-green rock. Its surface over all is nearly level, but as with a file, an array of little sharp points as subsidiary ornament provide peculiar harshness to the prospect.

The population and any fertility near the watershed is to be found along a few deeply dug-in valleys. Every reach with a fair development of terrace has some date palms, and nearby there may be a few huts. In some of the subordinate tributaries there are even a few fields. These are not natural but man-made. First a stonework dam is constructed across the gully. Then, in a wet year when it may rain hard for a day or two, perhaps once, or perhaps more often in the winter, a spate comes down for a few hours. The hills though composed of naked rock are not made of sound rock. The strong sunshine during the summer days followed by cold nights at altitudes between 4000 and 5000 feet breaks up the surface of the rock so that it crumbles and forms blocks set in sand and dust. Some of this is swept down with the water in those few years when rainstorms break so that a porridgy

sludge is carried down so far towards the sea. The dam impounds some of this slush, and when the spate is over the water drains away from it leaving a body of silt. A few such additions and the field is made. To preserve it a shallow drain is constructed along one side and, of course, the wall is tended carefully. Sometimes a wall may have been built up to a height of 20 feet, though more often one of 10 feet will suffice. The maintenance of such a field, apart from accidents like a cloud-burst, depends upon reasonable security, for, should a wall be destroyed in the course of a raid, and in Baluchistan feuds are still active, one good rain and the field is swept away. It is rather the reverse of the 'Oman method of destroying the canal that carries the water to an inlet or valley, but the result in both cases is the same, namely that a habitable valley may be reduced to famine, and possibly desolation, by the destruction of simple engineering works.

A small basket industry has been carried on near a group of these date gardens. They are plaited from the leaves taken from the fronds of the date palms themselves. Scores are made and hung together in a bushy storehouse waiting for the harvest. This was gathered in one little village we passed and the whole left in one place outside the village without guard or watchman, there being a convenient convention that from that place there shall be no pilfering. It is interesting how absolutely the tribal people throughout Persia respect a rule of this kind applied to a selected spot when they seem to honour no other pact. One use of the ribs or branches of the date palms is to furnish the frames of their oval huts. Several of these stems are stripped of their leaves and tied together with fibre into a dome-shaped cage about 6 feet high, 6–8 feet across the shorter axis, and 10–15 along the longer. These skeletons are anchored by stones and are used for huts all over the southern district, especially where there may be seasonal grazing. They can be left on the chosen sites and will serve year after year. The mats to cover them are carried along on a donkey and tied on to the waiting frame when a family comes into residence. Unlike the flat-topped houses of Kurdistan which collect dirt and vermin to such an extent that, though vacated each spring for the summer, it is perilous to enter them because of the voracious hordes of fleas, these are kept relatively clean by a combination of sun and wind. Baluchistan as a whole seems to be surprisingly little fouled by unhygenic methods of man, but then the population is far from dense.

The general pattern of the watershed along the southern side of the depression is a high range or plateau at about 5000–6000 feet standing some 20 miles or so from the edge of the alluvium. The desolate olive-green hills and the high reddish-brown tablelands of the Makran stand between it and the Gulf of 'Oman, and the tract of broad waterways, jutting peaks, and strangely coloured rocks between it and the silts of the Jaz Murian. The rocks are light and dark grey, pale and deep green, blues and blacks, and there are streaks of white, pink, and red. The junction between them and the silt is fairly straight if the indentations made by the estuaries of gravel be ignored, but there is no more direct evidence that it is controlled by a fault or faults. The villages always stand well back from the junction beside an expanse of gravel near the mouth of a watercourse, but a few wells have been dug close to it and are used for watering the flocks when they are grazing into the plain

itself during the spring. Some rather big date-groves exist along the river fans, but they are often far apart. Their presence is always the reason for one of the larger villages.

A striking exception to the usual plan occurs near Fanuch. The watershed forsakes the obvious line of the range and turns north across the coloured rocks to a subordinate ridge, which at the col between Mask Hutan and Fanuch is only 2850 feet above sea-level. The Fanuch basin spreads over a salient nearly 15 miles deep and 25 miles across. Easy rolling land and plain lies within it, although peaks to the north-west are wild enough. Most of it has a foundation of granite, or some such plutonic rock, where drainage collects and waters the fine date gardens at Fanuch before being trapped and hurried through a narrow wild gorge, so narrow indeed that although it presents a winding but perfectly easy road for camels, the water is generally at the surface. At most it rarely disappears into the gravel. The gorge breaches the one persistent range to a depth of nearly 3000 feet, and the stream rises in a gentle rock basin with a surprisingly mild topography. All its neighbours to the west rise on the southern flanks of the range, and none to the east breaks through in such a fashion. Why it should have done so arouses the traveller's curiosity, and points to great erosion since the sea last withdrew.

Sir Percy Sykes describes Ramishk and its environs as a rather populous and fertile basin hemmed in between the main southern range and a bold highland near the edge of the Jaz Murian depression. Its aspect is probably much like that of the upper Fanuch catchment, although it drains west and north instead of east and south. The main range carries on unbreached southwards of Ramishk where it is crossed only by a few donkey tracks which have to climb an altitude of 5500 feet at least. Buhan is one of these minor passes situated some miles north of Anguran. The trend of the ridges in the range, and of the range itself turns gently west-north-west a little west of Buhan, and 20 miles farther on they fall as spurs to the plain south-east of Manujan.

Sand-dunes exist at many points in the depression, but they are mostly small, sparsely scattered and with no persistent orientation. Some near Bampur run north and south, and others near Dusari and Bijnabad seem to be indeterminate. Most of them are anchored by grass and shrubs. A much larger area of sand occurs in the south-eastern sector of the basin than is found elsewhere. It is piled up against the southern rock wall and covers rather steep rock faces up to a height of about 3000 feet. Three rocky islands emerge from its central hump, for which they are probably responsible, and the sheet extends inwards and north-westwards where it envelops a considerable area of silt. In this same district valleys and rocky cols have been sanded up, which in one case provides a cross-country route practicable for camels between parallel valleys and saves a long detour out to the plain and back again in concentric, or east and west travel. The sand-covered country is oval in shape, approximately 12 miles from east to west and 8 miles from north to south.

The origin of the depression with its water residue still fairly fresh in spite of the vigorous evaporation and concentration is not quite clear, but some facts are worth recording or recapitulating. A little speculation follows and

an attempted solution is given. The debris filling the depression is made up of material of many degrees of coarseness, and it has collected at rather variable heights. Traced along its northern edge from a point north of Dusari in the west, *via* Khushrin in the centre to near Iran Shahr in the east, the plain falls from 2300 feet above datum to a little under 1500 feet, and then rises to 1700 feet. The terraces overlooking it are about 250 feet higher in the west, 150 feet higher in the centre, and about 200 feet higher in the east. The sheet of debris which forms the plain reaches a higher level almost everywhere on the southern side compared with the corresponding longitude on the northern, but the terrace is not so well defined. The closure of the plain at the eastern end also shows a gradient from 2100 feet near Aptar on the north to 2400 feet near Nashahman, 16 miles to the south.

The west is quite different, for not only is the limit of the plain much lower, reaching no more than 1250 feet close to Khan-i-Mirza, but it rises gradually northwards instead of southwards, and is about 1600 feet rather east of Kahnu. The edge of the plain between these two villages is broken by a veritable archipelago of rocky stacks, providing a landscape even more forlorn than that of the plain. The Halil Rud runs north-west near the centre of the funnel-shaped projection of plain which rises fairly steadily with the river from 1500 feet east of Kahnu to 4200 feet about 50 miles to the north-north-west where the rocks close round the head of the Jiruft district. The gradient of the watercourses which flow parallel to the Halil Rud and south-west of it is very similar to that of the Halil Rud itself to the 1500-foot level. Below that there is not a marked change in slope until near Birinti where the Birinti river enters its gorge and falls more rapidly. It has already been remarked that these rivers enter rock channels or cross gravel plains with little or no disturbance of their rate of fall. The part of the Jaz Murian which sometimes floods is about 1000 feet above sea-level, and there is a considerable but not yet thoroughly surveyed area around it which rises very gently indeed from the "shore-line."

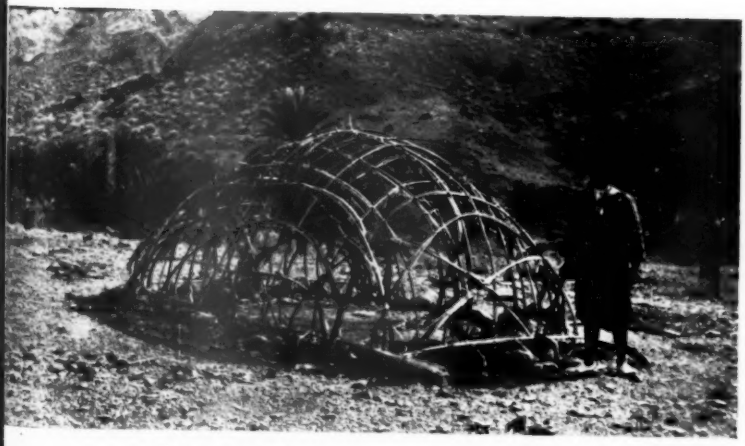
Two principal theories have been suggested to explain the occurrence of the sumps and their peripheral terraces in the enclosed basins of Western and Central Asia. One of them postulates steady or spasmodic drying up of a lake as the climate changes through decreasing rainfall; the other calls for warping action as well as dessication whereby the edges are raised and the centre depressed. In the former the terraces will be slightly inclined inwards, and in the latter more strongly tilted. The review given above of the height of the edge of the Jaz Murian plain and of the remains of its terraces demonstrates variations which are hard to reconcile with deposits laid down in any lake, and they certainly could not have originated in one where the overflow channel or sill was the lowest col on the divide at the present day at 1650 feet. Some of the unevenness may be due to recent accumulation of detritus from the rock walls direct, but this is no more than local and exceptional. Most of the variation shown by the boundary between plain and rock wall can be explained as a filling of a former valley system which probably discharged to the south-west into the Gulf of 'Oman or the Persian Gulf.

The headwaters of the Halil Rud flowing south-east from the western slopes of Jiruft assume an almost identical pattern with those tributary to the

Fanu

Fanuch village, with the main range on the south falling to the gorge on the left

Baskets of date palm near Parud



Frame of Baluchi hut from near Machan

Chah Sherif, dunes near Vakilabad

Desert east of Bijnabad

Flock of sheep at Bijnabad

Birinti stream which may be interpreted to mean that they both had a similar history in their upper part, and the gentle character of the wide middle valley above Birinti provides a gradient comparable with that of the Halil Rud. The gorge below Birinti and that above Minab both indicate that uplift has affected the terrain drained by the river. The raised beaches along the Makran Coast and the Persian Gulf support this conjecture and demonstrate that three movements have taken place recently amounting in all to about 400 feet. Other evidence of recent vertical movement is provided by the conspicuous escarpment between Kahnu and Khan-i-Mirza, a line which is peculiarly prominent when viewed from the air although sufficiently clear from the ground.

I think it may be the case that the Jaz Murian depression was shut in by recent faulting movements. The Halil Rud with the Bampur Rud formed a valley system which united close to Khan-i-Mirza and discharged southwest past Manujan to the sea. When faulting happened the land to the west rose, possibly about 1000 feet, and dammed this valley. At the same time the plateau farther west was broken up into large slabs which moved up and down relatively to one another to an even greater extent. Though geologically recent, the time was prehistoric and the rainfall was probably greater than it is now. This helped to move along the sheets of gravel removed from the slabs of plateau which had risen and to cover in their neighbours which had moved down. The rain was not copious enough to fill the newly formed Jaz Murian basin for there is no sign that it ever contained a sheet of water standing much above the 1000-foot level. The freshness of the residue which is found in the wells near the floodable area now is probably explained by any legacy of salt water left by the partial flooding by the sea in Pliocene times having been carried away when the combined rivers discharged to the sea. This drainage did more, for although its collecting area has a rock foundation composed of only slightly soluble materials, the early run-off had leached away any saline deposits which may previously have existed. The present catchment is almost ideal for a water-supply of good type, and no sounder testimonial to this opinion could be given than that the very dregs of its concentration over many thousands of years under a fierce summer's sun is still drinkable.

At least as speculative, and no doubt as controversial, is the question of the climate during historic times. There are two schools of thought. The one holds that the rainfall is progressively diminishing although admitting that the decrease takes place intermittently, with cycles of lesser drought interculated between others of greater drought. The other submits that there is no evidence that desiccation has increased in human times but places emphasis on the effect of long periods of insecurity which have resulted in the decay and destruction of the engineering works of man which served to make good use of the water given him. Nowadays few engineering works of any kind survive in Baluchistan or its borderland, which may be due to the several visitations of rapine which have swept over the country in the thirteenth and fourteenth centuries under Jenghiz Khan and Tamerlane respectively. No less devastating was the incursion of the Afghans in the eighteenth century, but even during the last few years things have not improved so much that

new building of water, or soil, conservancy works can be thought of. Perhaps the decline may not have been wholly the result of invasions, for mere indolence and neglect will soon achieve the same effect, and under the influence of uncertainty and a tryingly hot climate, such frailty can certainly be condoned. If we are to believe the story of Alexander crossing the Jaz Murian with an army, even when the accounts of his legions have been stripped of their oriental embroidery so as to eliminate natural exaggeration, we have to think of a much more fertile basin than exists now. This can be visualized on the assumption that the Jaz Murian had experienced a long period of stable government and planned public works some two thousand three hundred years ago, and without any wetter climate than now exists. The decayed qanats and choked canals testify that old works were once in existence, and Sir Aurel Stein points out that they were built after the chalcolithic age, when the distribution of settlements was much as it is now. There were none at all along the northern side of the Jaz Murian, in the now neglected districts, where in post-chalcolithic times there was cultivation irrigated by water drawn from the flanks of the depression by qanats.

In conclusion a little may be recorded about the geological history of the region (see map pp. 222 and 223). It is underlain by a massif of very old rocks which are best seen in the hills at the western end, but they are also exposed east and west of Mask Hutan and in a small area near Hamant. Just how old these schists, gneisses, and coarse-grained intrusives may be is not known, but they are strongly folded and altered while limestones and shales at Bur Kuh are gently folded and are not altered. These are known to be Carboniferous and perhaps older. It is tempting therefore to regard the metamorphic rocks as being Pre-Cambrian. At all events they had been planed off nearly flat before the beginning of the Jurassic when some of them were covered by a shallow sea, and locally beds of that age containing fossils were laid down. Throughout the Jurassic and Cretaceous periods the area was restless, sometimes submerged, sometimes dry land. Volcanos were often in eruption and they supplied ashes to make muds and siliceous acids to produce the flint or chert which is often found here in association with lava flows and occasional reefs of limestone. On the north, much earlier in palaeozoic times, there was an open sea on the flank of this older block, and marine conditions may have persisted here until the Middle Jurassic.

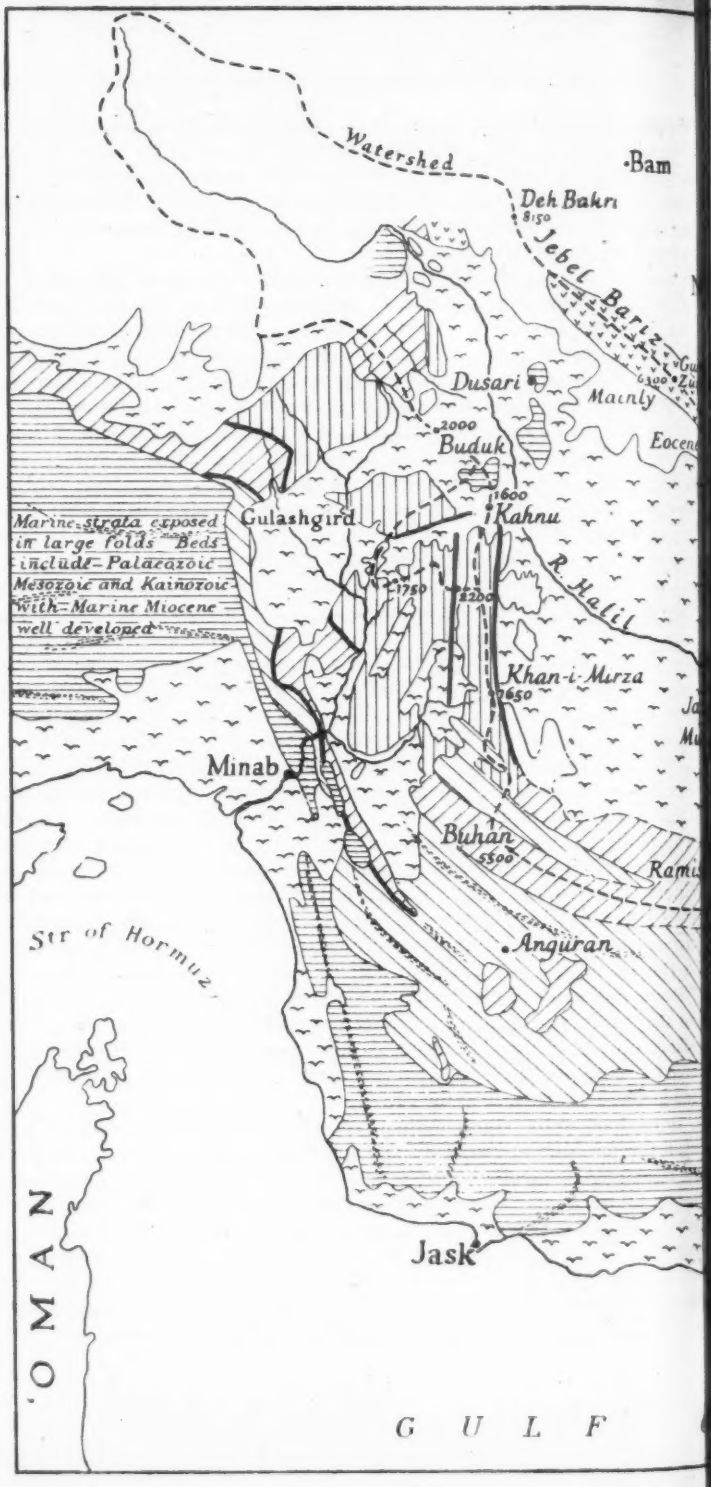
Strong mountain-forming movements occurred in Persia about the end of the Cretaceous and a subordinate effect of these caused either tilting or block faulting of the massif to take place. This was followed by erosion which laid bare a great volcanic basement in the north-west, the granite core of Jebel Bariz. A series of volcanos was situated around this granite mass in the Eocene, and the sea washed around the base of some of their cones. It distributed sheets of gravel and sand derived from them and built a few reefs of limestone full of fossils amongst them. Around the edge of the Jaz Murian block things were different, for there the sea rolled in and sorted great quantities of volcanic ash into clays and sands which it then spread out in innumerable thin sheets alternating in an entirely sporadic fashion. In aggregate they formed a great and sometimes tremendous thickness of beds. The occasional reef, and infrequently a fossiliferous calcareous bed occur

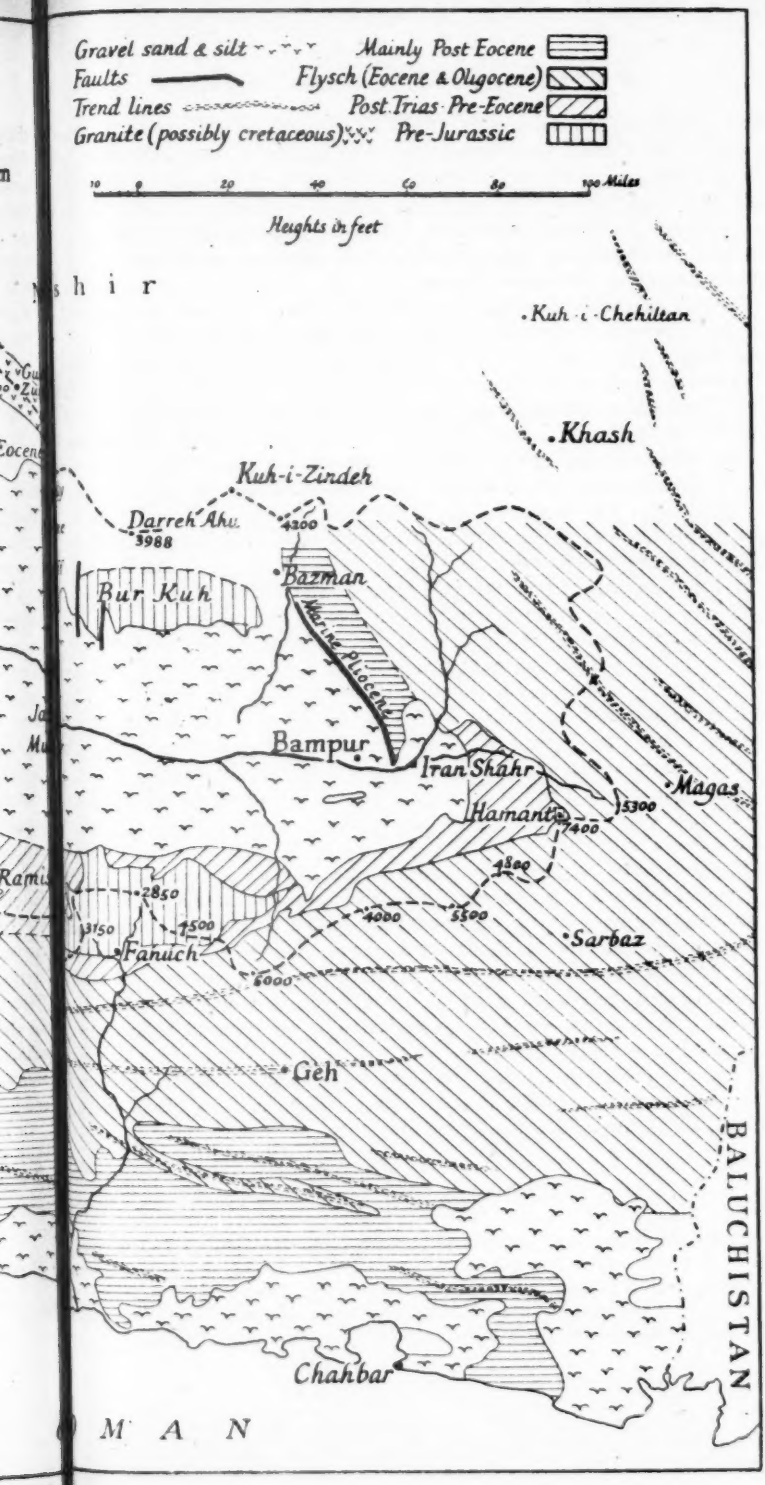
amongst them and serve to date them. In this outside sea conditions in the Oligocene differed little from the earlier Eocene except that some of these beds were worn away and redeposited so that the Eocene fossils have been found in pebbles in the gravelly beds. Over the massif there was an Oligocene sea where an extensive sheet of limestone was laid down after the Eocene volcanic eruptions had stopped.

It is probable that most of the country was land during the Miocene. None of the marine beds which persist for over 1000 miles to the north-west from Bandar Abbas have been discovered here. On the other hand the Miocene beds north-east of Bandar Abbas have been observed to change from limestone and gypsum to sands and gravel in a very short distance, as if they were in proximity to a shore-line once located just west of the Birinti district. Then came the Pliocene when the sea again flooded a wide fringe on the south of the Jaz Murian land as well as on the west. In addition an arm of sea at least 20 miles wide and of unknown length covered a depression north of Bampur. Indeed it may have been much more extensive but to what extent cannot be assessed as relics of its beds are preserved only in a few favoured places, such as the range overlooking the Bazman road, for instance.

Until the late Pliocene the Pliocene beds were lying almost flat upon older deposits around the Jaz Murian block, and these older beds were also folded only moderately, but then the crust of the earth was vigorously shortened. The thick Eocene and Oligocene beds suffered intensely and were puckered into many sharp folds, while the Pliocene deposits along the south coast were moulded into a series of basin-like folds with only their edges strongly affected and upturned. This all resulted from a movement of Russia and Africa towards one another. The immediate effect was that the Jaz Murian massif was moved as a whole about 70 miles south, and rucked up the sediments lying south of it very severely in the process. It also dragged a narrow strip of them along on its western margin, where the Eocene and Oligocene beds are drawn out in sharp or broken folds running north and south and forming the Zindan Range. The crowding together of the continents also affected the mantle of beds to the east where their impact upon the massif at Hamant forced them into the steep diverging folds running away to the north-north-west on the one hand but keeping east and west on the other. The Pliocene sediments of the Bampur region suffered distortion at this time too, for they were moved upon the eastern projection of Bur Kuh like waves rolling up a seashore. The front of this group of waves broke and slipped over the nose of the obstacle along a thrust fault aligned north-north-west and inclined downwards to the east.

In contrast to the strong folding around Hamant the beds actually lying upon the Jaz Murian massif did not suffer much. They are warped a little, for the strata frequently depart somewhat from the horizontal, but they are hardly folded at all. Nevertheless the massif did feel the stress and suffered strain which was relieved later by large-scale normal faulting. The drainage had been initiated and ancestral rivers formed before the faulting developed when the whole southern region was rather low lying. The watershed was probably much as it is to-day west and north of Jiruft and along the north of the Jaz Murian; to the south a spur may have risen approximately along


Watershed
Bam
Deh Bakri
8150
Jebel Bariz
6300
Dusari
Mainly
2000
Buduk
Eocene
1600
Kahnu
Gulashgird
Marine strata exposed in large folds. Beds include Palaeozoic Mesozoic and Kainozoic with Marine Miocene well developed
1750
2200
R. Halil
Khan-i-Murza
7650
Minab
Buhan
5500
Str of Hormuz
Anguran
'OMAN
Jask
G U L F


Gravel sand & silt
Faults
Trend lines
Granite (possibly cretaceous)
Mainly Post Eocene
Flysch (Eocene & Oligocene)
Post Trias Pre-Eocene
Pre-Jurassic
10 0 20 40 60 80 100 Miles
Heights in feet
Kuh-i-Chehiltan
Khash
Kuh-i-Zirdeh
Darreh Ahu
3988
4200
Bazman
Bur Kuh
Marine Pliocene
Bampur
Iran Shahr
Magas
5300
Hamanti
7400
4800
2850
3150
4500
4000
5500
Sarbaz
Fanuch
6000
Geh
BALUCHISTAN
Chahbar
M A N

the southern edge of the massif. All the rivers discharged near Minab. The source of the Fanuch and Sarbaz rivers was situated on the southern spur whose ridge lay considerably farther north than does the axis of the main southern range to-day. The rainfall may have been heavier and was certainly better distributed inland than it is to-day for it then nourished those streams entering the southern Lut which were powerful enough to construct the great terraces still exposed to-day.

Then came a time of readjustment after the phase of folding accompanied by great changes in elevation. The south-western wall of Persia gradually rose along a front 1400 miles long and developed as a lofty bar, lying almost everywhere on the seaward side of the original watershed. All along this the rivers have had to cut across the new elevations which tried to cut them off from the sea and their gorges, often as much as 5000 feet deep, bear witness to this modern uplift. In the Makran the elevation of the youngest Pliocene marine beds to 6400 feet shows how great the minimum vertical movement has been here. The Fanuch gorge is the most striking evidence in the Jaz Murian district that highlands once extended much farther north to the edge of the present plain, and that here too the plain on which the streams were born has been distorted and perhaps broken. The highest range now corresponds to the zone where the disturbance has been greatest.

This newly elevated land obstructed the winds, and so affected the precipitation. The differential uplift was probably responsible also for the start of the faulting which gave us the dice-shaped slabs to the west of the Jaz Murian, and caused the central part of the massif to sink relatively to the western fragments. These vertical movements did not take place without a certain amount of bending locally as is revealed by cases of warping near the margin of the plain. The last rise of 400 feet was accomplished recently with the formation of the raised beaches and the fine terraces of the Makran, the Gulf Islands, and much of Laristan. Judging from the state of preservation of the fault scarp between Kahnu and Khan-i-Mirza it is possible that the movement took place here at about the same time, and as has already been surmised, may have cut off the lower part of the Halil and Bampur river system and isolated the Jaz Murian depression. This change seems to have been brought about after the main uplift of the south-western mountains which reduced the rainfall in all but the Caspian provinces of Persia. Hot springs, volcanos, and earthquakes enduring to the present time suggest however that vertical adjustments may still be proceeding. The change in climate was prehistoric. Local variations in population and fertility since then are imputed to political catastrophes which have so often affected Persian affairs throughout the course of history.

DISCUSSION

Before the paper the PRESIDENT (The Rt. Hon. Sir GEORGE CLERK) said: Dr. J. V. Harrison is a member of the Council of the Society and is well known to us for several interesting papers on little-known parts of Persia, which he has had to investigate for the Anglo-Iranian Oil Company. He will now give us a paper on the great Jaz Murian Depression in Persian Baluchistan.

Dr. Harrison then read the paper printed above.

The PRESIDENT: Dr. Harrison has given us a most interesting paper. I must say that, though he may be enthusiastic about the country, I should not wish ever to have to go over it still less live in it. I do not think I have ever seen a country that tempts me less. Perhaps my tastes are soft. I am sure we are all very grateful to Dr. Harrison for his paper. We have learned from it something of a part of the world of which but few of us knew anything at all. I would like on your behalf to express our thanks to Dr. Harrison.

THE FOXE BASIN COASTS OF BAFFIN ISLAND

T. H. MANNING

Previous exploration

EXCEPT for Eskimo report, the central west coast of Baffin Island was totally unknown until 1910 when Bernhard Hantzsch (Anderson 1930) with two Eskimo families crossed to it from Cumberland Sound. The ship which took Hantzsch to Cumberland Sound was lost with most of his possessions, so that the party was poorly equipped and short of ammunition. Travelling first by *komatik* and then by boat, they arrived at the mouth of the Koukdjuak on September 20, and six days later started for Hantzsch river, where they arrived on November 5. As with us in 1938 and 1939, most of the caribou had by that time left, and seals were scarce and difficult to hunt owing to the rough ice. After a winter of considerable privation, Hantzsch, accompanied by two Eskimos, proceeded northward in mid-April as far as the region of Straits bay, or perhaps nearly to Piling; since though it is not marked on his map, he may have passed the former place without realizing its extent. On his return, Hantzsch, who had been ill for some time, died, and was buried a little to the north of the river that bears his name. The Eskimos all returned safely to Cumberland Sound with his diaries, notes, and specimens.

In the summer of 1925, Soper (1928, 1930 *a*), accompanied by Constable Tredgold of the R.C.M.P., travelled around and mapped the southern shore of Nettilling lake, proceeding a short way down the Koukdjuak river. During the following winter, Soper again travelled from Pangnirtung, and reached Foxe Basin, mapping the remainder of Nettilling lake on the way.

The south-west coast of Foxe Peninsula was approached much earlier. Christy (1894) on his map of the north-west voyages between 1610 and 1632, shows the courses of William Baffin and Thomas Bylot in 1615, and William Hawkridge in 1617, as passing between Mill Island, which was named by Baffin (Purchas 1906, p. 389), and the southern shore of Foxe Peninsula. Except that Baffin landed in one place where the land was low and the sea shallow (Purchas 1906, p. 391), there is no more than a casual mention of land in their accounts of these voyages as given by Luke Foxe (Christy 1894) and Purchas.

In 1631, Foxe, on his return voyage, sailed along the west coast of the peninsula, to which according to Christy (1894, p. 386), Parry was the first

to give the name of Foxe Land. As the result of this voyage, Foxe produced a map of the coast which was, unfortunately, on too small a scale to show adequately all the features, or to allow the use of all the names mentioned in the text. The consequent confusion is increased by some inconsistencies in his account, particularly between that published, and his MS. It is however not unreasonable to expect that changes would be made in the latter before publication; and moreover the manuscript which Christy quotes is not the original (Christy 1894, p. cviii), so that copyist's errors are possible.

The cape now known as Dorchester is in Foxe's published account (Christy 1894), obviously named Lord Weston's Portland, and is even marked thus on the accompanying map, while his Cape Dorchester probably corresponds to Soper's Cape Enauolik. Parry (1824) was first responsible for this mistake, having perhaps taken the name from a copy of Foxe's manuscript which he had with him on his voyage of 1821–23. Although correctly shown on Parry's map, Soper has given to King Charles Cape[1] the position that Foxe refers to as "Prince Charles his Foreland of Baffin"; the small island to the west received from Foxe the peculiar name of His Nurse, and the bay to the east, His Cradle. The Cape Dorset of Foxe probably refers to a point farther west (cf. Christy 1894, p. 396). These names however are now too well established in their present positions to permit readjustment.

About 1880, Captain Spicer, a whaler, several times visited the west coast of Foxe Peninsula and wintered at Spicer's Harbour, which is probably identical with Schooner Harbour on the present map. Other whalers also used the harbour, and perhaps a considerable amount of whaling was done in the district. In 1879, Spicer discovered the Spicer Islands. These islands were very low, being barely visible from the deck at high tide (Wakeham 1898, p. 59).

In 1921, an expedition under Donald B. MacMillan wintered at Schooner Harbour. A member of this expedition, G. D. Howell (1928), took magnetic observations and obtained astronomical positions, including one at Cape Dorchester and two along the north coast to the east. In 1924, Major L. T. Burwash (Millward 1930, p. 60) made a sketch-map of the coast as far north as Cape Queen, and from there crossed nearly to Southampton Island.

In 1927, some members of the Putnam Baffin Island Expedition (Putnam 1928) left the expedition schooner, and journeyed along the north coast of Foxe Peninsula to Bowman bay by whaleboat. The coastline was mapped, and geological work was carried out by Gould (1928 *a* and *b*).

In 1928, Soper (1930 *b*) began his mapping of Foxe Peninsula with a survey of the west coast from Cape Dorset to the Putnam expedition's cairn on Cape Dorchester. During the following winter, he made several traverses across the peninsula, and in March and April of 1929, mapped the coastline from Bowman bay to Hantzsch river as well as part of that river. The summer of 1929 Soper spent at the blue goose colony at Bowman bay, and later mapped the coastline from there westwards to Gibson bay in greater detail than had previously been done by the Putnam expedition.

[1] The position of this cape is correctly shown on the map of the Northwest Territories and Yukon prepared by the Department of Mines and Resources, 1939. Scale 1 inch: 80 miles.

The Hudson's Bay Company's trading post at Cape Dorset was established in 1915; that of the Baffin Trading Company in 1939. In the latter year a Roman Catholic mission was built, though for some years there had been an Eskimo lay reader there for the Anglican Church, and all the Eskimo belonged to that denomination.

The northern coast of Foxe Basin was first visited in 1822 when Parry (1824) sailed about 25 miles to the east of the Calthorpe Islands. In the following winter Lieutenants Reid and Hoppner of the same expedition visited and mapped the entrance of Murray Maxwell bay and a portion of Gifford river. In 1867 and 1868, Hall (1879) visited Igloolik, and during the latter year, crossed to Baffin Island for a short time. Although Foxe Channel seems to have been visited quite often by whalers from about 1855 onwards, it is very doubtful if any of them reached the northern shore of the Basin, and certainly no further mapping of that coast was done until the visits of Therkel Mathiassen and Peter Freuchen of the Fifth Thule Expedition between 1922 and 1924 (Mathiassen 1933). The farthest west reached was Steensby Inlet, but several crossings of Cockburn Land were made.

Toward the end of 1936, R. J. O. Bray (1938) and G. W. Rowley left Repulse bay for Igloolik, and from there made a winter journey to Piling, mapping the coast on the way. Later, Rowley crossed to Pond Inlet, and Bray to Admiralty Inlet. In order to supplement this survey, Bray and P. D. Baird planned another visit to Piling in 1938. Although their plans were prevented by Bray's death, Baird reached Piling the next year, and travelled inland from there for some distance. That same winter Rowley crossed from Steensby Inlet to Glenroy fjord, Cambridge Gulf. I believe that Canon Turner in 1941 crossed from Clyde Inlet on the east coast of Baffin Island to Piling.

The Hudson's Bay Company's trading post at Igloolik was established in 1939, two years after the Roman Catholic mission had been built. Father Bazin however had been there for some years before this.

Narrative

An account of the earlier work of the British Canadian Arctic Expedition [1] has already been published in the *Geographical Journal* for 1940 (Bennett). This concluded with Bennett and Baird's walk from Canyon river to Coral Harbour to obtain transport to Churchill.

Southampton Island, August 1937–July 1938

On 22 August 1937 I was able to continue with the *Polecat* along the coast to Mathiassen brook and Caribou Island, at both of which astronomical positions were obtained. With a north-east wind on September 6, very heavy ice began to come into East bay and around Caribou Island. I left the latter place on the afternoon of that day, hoping that once beyond Terror Point conditions would be better; but when I was just off the point, the ice closed rather suddenly, and the rudder was immediately smashed. During the night the wind dropped, but I was unable to extricate the boat until the next day. By that time a considerable amount of gasoline had been used, I was

[1] The expedition, which consisted of G. W. Rowley, R. J. O. Bray, P. D. Baird, P. M. Bennett, and R. G. M. Keeling was led by T. H. Manning.

short of dog food, and steering amongst ice with only an oar presented such difficulties that I decided to winter at East bay. A few days later the ice was blown well out, but the *Polecat* had by then been unloaded, and it was too late to continue. Most of the winter was spent at East bay, though a few astronomical positions were taken at various points to supplement my earlier map (Manning 1936).

In the hope of making an early start toward Baffin Island in the summer I obtained the assistance of John Ell and another Eskimo, and hauled the *Polecat* overland to Native Point in the spring of 1938. The total weight of the 23-foot *komatik* was probably between 4000 and 5000 pounds, and although conditions were ideal in late March when the move was made, it was found necessary to use mud (Manning 1936, pp. 233–234) about 10 inches wide on the runners to prevent them sinking through the hard crust which, however thick, is always present on grassland. With the *komatik* thus shod fifteen dogs were ample on the flat.

After making arrangements with an Eskimo to paint and repair the *Polecat* and later join me with her, I went toward Seahorse Point by dog-team, arriving at Expectation Point about 6 miles west of there on May 19. There we set up our camp for the summer. On this trip I had with me an Eskimo, Sandy, and his wife, who were to accompany me to Baffin Island. Sandy was the adopted son of John Ell, an Aivilik Eskimo well known in the eastern Arctic.

As the *Polecat* did not arrive we remained at Expectation Point till July 5. During this time I obtained the longitude of Seahorse Point which, I regret to say, showed that my previously estimated position of the point (Manning 1936, p. 240) had been considerably too far west. Its true position is 80° 00′ 18″ W. Some old Eskimo stone houses on Expectation Point were excavated and birds studied and collected.

On July 5 the ice cleared sufficiently for us to search for the *Polecat* with canoe and outboard motor, a move that was indicated by lack of food, and the difficulty of obtaining seals in the deep water that bounds the high land of Bell Peninsula, after the ice had broken off on July 3. We met the *Polecat* near Leyson Point on July 6, but shortly afterwards the ice once more became impassable, and we had to stay at Anderson river till the 16th, when a strong easterly wind pushed the ice past us, presumably through Evans Strait.

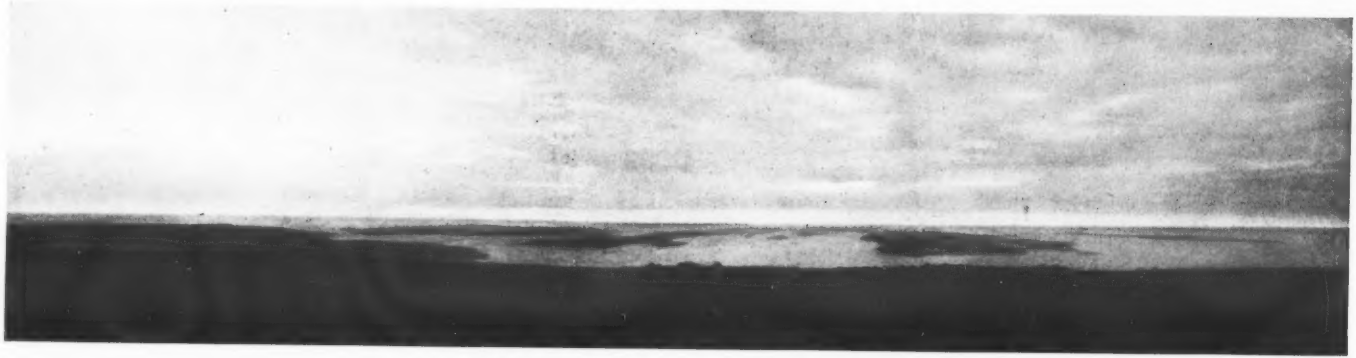
Baffin Island: July–December 1938. *Cape Dorset to Hantzsch river*

We left for Cape Dorset on the 18th, but as we had insufficient gasoline for that distance, we made for the government radio station at Nottingham Island. We spent a few hours on Nottingham Island, and about a day and a half on the north-west end of Salisbury Island. On the way to Nottingham Island we saw no ice, and only a few scattered pieces between there and Cape Dorset which we reached on July 24. The *Nascopie*, with my future wife on board, arrived the same day.

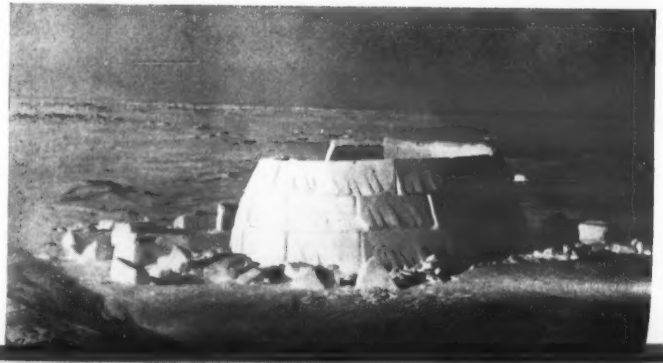
We left Cape Dorset on July 30. Besides my wife and myself, the party consisted of Sandy, his wife, and a small girl, the adopted daughter of John Ell, whom Sandy had borrowed for the trip. We took 9 dogs, 4 pups of varying ages, about 200 gallons of gasoline, 2000 pounds of dog pemmican and as much provision and kerosene as the 30-foot *Polecat* and two freight

The "Polecat"

Loading "Polecat" and canoes at Cape Dorset, 30 July 1938



Piling bay from the top of Longstaff Bluff



canoes would carry. The first of these canoes, which we towed one behind the other, was 22 feet long, and of the greatest beam and depth obtainable. It was reasonably seaworthy with a load of 2000 pounds, but had to be grounded with great care when fully loaded. The second canoe was 20 feet long, and held considerably less.

After about 20 hours' travelling, we stopped near the Bird Islands, and again some miles farther north where there were said to be some Eskimo house ruins, which we were unable to find. On August 4 we went on to Nuwata, which was then the last Eskimo summer camp along the coast until well past Piling, about 300 miles nearly due north. Here we excavated old stone house sites while waiting for gasoline to be brought from Cape Dorset.

We left Nuwata on August 12, but were stopped on the opposite side of Finnie bay by ice, the first, except for loose pieces and strings off Cape Enauolik, that we had seen since we left Cape Dorset. The three days we were held up by ice were spent excavating at some houses near Storm Cove. Unfortunately these, like those at Nuwata and most of the numerous villages on the south and west shore of Foxe Peninsula, had been much disturbed in recent years by Eskimos seeking curios for sale. Near them was a line, 120 yards long, of walrus jaws and hind-flipper bones placed end to end. Although some of the bones were old, they had probably been placed in position comparatively recently, possibly by natives who had seen a similar line of skulls at Hut Point, called by the Eskimos Neaqortartujuk (the Place of Skulls), on Southampton Island.

On the 15th, a north wind removed the ice and we were able to round Cape Dorchester. A little to the east of there we were held up for a few days by bad weather, but were not again troubled by ice till we reached the east end of Gibson bay. From there to Cape Alberta there was heavy ice, but the weather was dead calm, and the strong currents, caused by the water running out of the very shallow bays as the tide fell, left a strip of water comparatively open except for large stranded pieces of ice. Soon after turning north across Bowman bay proper we ran out of ice into clear water, seeing only a few pieces of ice until Hantzsch river was reached on August 24.

We had no winter clothing, as I had been relying on caribou skins bought from the Hudson's Bay Company the previous year. Unfortunately however these had been sold when in 1937 I failed to arrive at Cape Dorset as expected, and, owing to the loss of one of the company's boats, they had not been replaced. Our first work therefore after the establishment of our camp, was caribou hunting.[1] Fortunately, and contrary to expectation, caribou were found to be numerous, although the hair was already too long for the best clothing. Fish nets were put out in the mouth of the river, and about 800

[1] Except in emergency, caribou may only be killed in the Northwest Territories by Eskimos, or whites with trapping licences. Had we obtained the skins ordered, I should probably not have had to hunt caribou in 1938, and early September could have been spent seal-hunting for dog feed. In 1939, there were no Eskimos or Hudson's Bay Company's posts within 200 miles from whom we could obtain them. Moreover much of our last year's clothing was in good condition, so that we needed comparatively few, and were able to concentrate on seal hunting for dog feed. A report of all caribou killed was made to the R.C.M.P. at Pangnirtung in 1941.

Greenland char were caught. They were of average size, probably weighing 3 or 4 pounds each.

On September 12 my wife and I started north by boat along the coast to do some mapping and hoping to secure walrus or seals for winter dog-feed and oil. Sandy remained behind. We were however stopped on the first day by ice which filled Wordie bay, and as we had brought no dogs with us it seemed unwise to be too far on the wrong side of pack-ice so late in the season. We saw no walrus and the weather was too rough for much seal hunting, but we secured several caribou. Returning to Hantzsch river on September 28, we hauled up the boat at the next spring-tides, as by that time ice had already formed around the shore.

Owing to lack of room in the boat, we had brought only two of Sandy's dogs with us from Dorset; so on October 11 he started off with four of mine to fetch them. It was necessary to take the smaller canoe for crossing the Koukdjuak river, and I accompanied him as far as Taverner bay to help him with this. From there to Bowman bay there would be very good going, since the spring tides which flood the short grass bordering the edge of the sea form thin layers of ice, which, perhaps because they are in contact with the frozen ground instead of the warmer sea, quickly lose the sticky saltness of sea ice.

From early October until the following May, no caribou were seen near the mouth of Hantzsch river or to the south of there, and only an occasional track south of Point Peters; nor did we see any tracks on a trip 15 miles up Hantzsch river in mid-October. A few Greenland char were caught in the broadening of Hantzsch river about $1\frac{1}{2}$ miles from the mouth, these were considerably smaller, and quite different from those caught at the mouth of the river earlier in the season. Professor Dymond however identified some not very well preserved specimens as being of the same species, *i.e. Salvelinus alpinus*, which is very variable. They were not plentiful, and fishing was discontinued toward the end of November.

The ice in Hantzsch bay did not make sufficiently for hunting the floe until the end of October, and by mid-November there was a band of such rough ice near the sea that it made hunting impracticable. Therefore we killed only three seals and were short of fuel, having no heat in the tent until November 8. A thaw in mid-October spoiled the snow for building, and not much fell the next month, but a snow wall was built around the tent, and the top was covered with caribou skins, which greatly helped to keep the interior at a reasonable temperature.

Sandy returned on November 29. He had had to go inland to Nettilling lake to avoid the Koukdjuak river, as there had been a large amount of floating ice; a journey which I think few Eskimo would have attempted over unknown country. After Sandy's return we had about 18 dogs at the camp, and as there appeared to be little hope of obtaining more dog-feed during the winter, it was decided that he and his family should go to our cache at Chorkbak Inlet. They left on December 19.

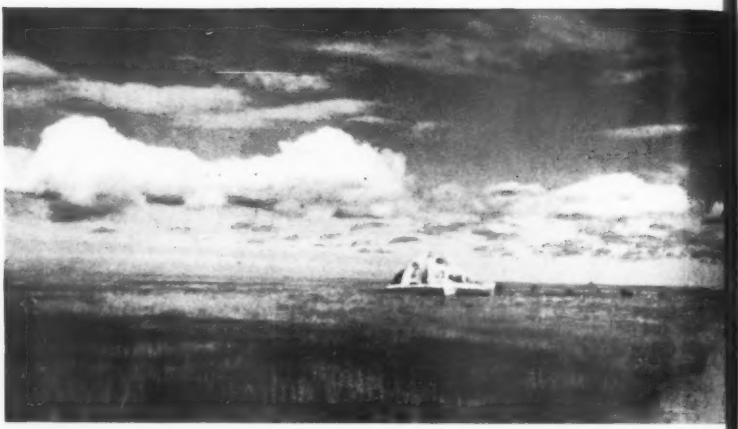
During the early winter, I made a number of short journeys, partly for mapping and hunting, but chiefly to preserve and bring into camp our caches as wolves and wolverines were rather troublesome. During this time my

Pangnirtung fjord from settlement, 26 February 1940

Camp at Taverner bay: feeding time, 23 March 1940. Note ice window

Breaking camp at Hantzsch river for move to summer camp at Taverner bay

Painting the "Polecat," 30 May 1940: Taverner bay



Canoe Camp, early July 1940

Blue goose by nest, 13 July 1940

wife was busily preparing skins and sewing our winter clothing, all of which she made.

On December 27 we went to Wordie bay, partly to hunt seals, and partly to map a small river that I had noticed flowing into the bay. The trip was chiefly notable for a very strong wind which several times cut through the side of our snowhouse, although I banked it and piled snow blocks up against it continuously. The house was not exceptionally exposed or built of very soft snow. On the windward side of some other old houses the snow was completely blown away, leaving intact the semi-transparent iced inside. This gale was by far the strongest I have known in the north. Compared with other gales which, according to the anemometer measurements at the Chesterfield radio station, rarely exceed 55–60 m.p.h., it probably reached at least 80 m.p.h. It lasted only about 11 hours. The temperature was between +15° F. and +20° F., and the weather remained mild for some days after.

January–July 1939. *Hantzsch river to Piling: mapping Hantzsch river*

On January 30 we left for Piling. On the way north we mapped the coast from Wordie bay to Piling, and on the return, the eastern side of the Tweedsmuir Islands. Until this trip, our radio, a five-valve National which I had got at Repulse bay, had worked excellently, but we had some trouble getting time signals at our first two fixes on this journey, and at Piling it completely failed though we spent five days experimenting with it. In order to get a time signal in mid-winter, the radio has to be brought into the snowhouse and warmed up from −40° F. to at least 0° F. so that the batteries will work; in practice, it was usually found more convenient, and the results appeared better, if it was warmed above +32° F. However carefully a radio is kept wrapped while being warmed, some frost always forms. This, I think, rather than the jolting of the *komatik*, is the cause of the failure after about one winter's use of all radios I have tried. Even if the radio were warmed in an airtight box, it would frost during the night or between signals unless put away or the snowhouse kept warmer than is ordinarily possible with the fuel available on a long journey.

Although caribou tracks were numerous between Point Peters and Piling, and several herds were seen, the weather was very cold, and for the most part, calm, making them very difficult to approach.

We got back to Hantzsch river on February 25, and on March 9 Sandy arrived bringing some supplies from our cache at Chorkbak Inlet. He returned there a few days later, and on March 22 my wife and I started inland to map Hantzsch river. The river is very winding, and proved difficult to follow. At first we thought it might be possible to cross to Home bay on the east coast, but the country was very rocky, with a complete absence of major valleys, so that there was no hope of being able to return by the same route and find caches left on the outward journey once the river had been left. Caribou were numerous inland of Soper Highland, and with the mild weather easy to approach; perhaps they had been there all winter, but it was problematical whether they could be relied on for a return journey. We followed the two major branches of the river as far as they could be distinguished, and returned across Soper Highland to Taverner bay.

The latter part of April and early May was spent hunting seals on the ice of

Hantzsch bay. Though not very numerous, most of the seals were of large size. Their fat was cut into strips, and placed in empty petrol kegs, the tops of which could be screwed up, allowing them to be conveniently handled. During the summer the oil rendered out, and, since care had been taken to exclude all meat and blood, remained comparatively fresh.

Sandy paid us another visit on May 23 to fetch the larger canoe and the outboard engine which we had given him for his service. He and his family returned to Southampton Island from Cape Dorset the following summer. On May 29 we moved for the summer to the north end of Taverner bay where many snow geese and blue geese had been observed during the preceding fall. But, although geese were numerous during the spring and fall, only one nest was found that summer.

July–December 1939. *Taverner bay to Cape Dorset*

On July 23 we left by canoe to fetch the *Polecat* from Hantzsch river. When we started there was no ice to be seen from the low hills at the north end of Taverner bay, and at Hantzsch river the ice was about 4 miles out from the mouth, though it touched the north end of the bay. While we were there the wind was variable, but the ice had not moved much when we returned to Taverner bay on July 28.

On August 3 we left for the Koukdjuak, hoping we should be able to go up the river to Nettilling lake and find a suitable camping site. We reached the river on the evening of the 5th, but after going 5 or 6 miles upstream, were obliged to stop as it was too dark for negotiating the shallow water. The next day we continued a little way up the river, but because of the amount of petrol we were using to make headway against the current, doubts as to whether the river would continue deep enough for us to reach the lake, the impossibility of stopping before the lake was reached unless the banks became higher, and our anxiety to search for two of our dogs who had fallen overboard, we decided to give up the attempt and to return to Taverner bay for the winter. Hundreds of blue geese and snow geese with their young were seen on both sides of the river.

During the late summer, 6 bearded seals and several ringed seals were shot. These, together with the fat stored during the spring, and a few deer, the skins of which we needed for clothing, enabled us to use as much oil as was required, and to keep our nine dogs in good condition throughout the winter.

On December 17, with rather a large load which included our bird and other specimens collected the previous summer, we left Taverner bay for Cape Dorset. As Soper had previously mapped most of the route followed, we did not make any stops for this purpose, and arrived at the Cape Dorset post on 1 January 1940. Our radio had not been in working order for about a year, so we then learned the first news of the outside world since the preceding spring.

January–July 1940. *Cape Dorset to Pangnirtung and Taverner bay*

After resting the dogs for about a week at Cape Dorset, we went overland to Cape Dorchester, the usual winter camp of those Eskimo who spend the summer at Nuwata, where we obtained the position of the Cape, using a new radio we had got at Dorset. We then went to the eastern end of Gibson bay, the most westerly point along this coast mapped by Soper, but our longitude

determination of this point was prevented by a wrong connection of the batteries which blew out our only set of valves.

After going on to the cache at the head of Chorkbak Inlet for dog feed and other supplies, we left for Pangnirtung. The route from Bowman bay to Nettilling lake was mapped in so far as any features could be found to map on that low, snow-covered route. The remainder of the route and the shore of Nettilling lake had been mapped by Soper (1928) and Weeks (1927). The main object of our journey was to have our teeth attended to by the government doctor at Pangnirtung, and to collect some supplies for the following summer. We were also fortunate enough to secure some new radio valves at Pangnirtung, and were therefore able to get a fix at Magnetic Point on the return journey, arriving back at Taverner bay on March 10.

On April 18, Herbert Figgures, the Hudson's Bay Company's clerk, brought us additional supplies from Cape Dorset, so that we should have sufficient flour and other necessities to last another winter if we were blocked by ice on our way out. During May we hunted seals on the ice at Hantzsch bay, and took part of our equipment for the summer down to Canoe Camp on the Great Plain of the Koukdjuak.

On the flat land where there are no rocks to catch the sun, a uniform covering of snow remains much later than in the more broken country, where some of the ridges are swept bare throughout the winter, and from which the snow sublimes rapidly during April. On June 21, when we put up our big tent at Canoe Camp, over half the land was still covered with wet snow, and the greater part of the remainder was under standing or running water. After some search, we found a place for the tent where the ground oozed water only slightly when pressed.

Up to June 23 only a few nests had been found although hundreds of blue geese and snow geese had been seen flying around during the two previous weeks. Therefore I started down the coast towards the Koukdjuak river. I followed the north shore of the river for several miles, then went to Soper Highland, and returned by way of Taverner bay. As the snow had by then completely gone, and the rivers were in full spate, I used a small *komatik* about 6 feet long with a rectangular seal-skin boat lashed to it to carry my camping and collecting material. I could also ride in this when the water was deep enough. Only a few goose nests were found, and I think only scattered birds nest north of the Koukdjuak river.

On July 6 we began our move to the south end of Taverner bay to be ready for the hatching of the eggs in some goose nests that I had found there previously. The ice had not yet broken up along the shore, but on this flat coast at spring tides there was considerable flooding on the mud from which most of the ice had thawed. Thus it was possible to push or row our freight canoe along the flooded strip for two or three hours at high-tide. All the ice went out of Taverner bay with a very strong east wind which began to blow on July 17.

August 1940–*January* 1941. *Taverner bay to Igloolik and Churchill*

We returned to the *Polecat* and our previous winter camp on July 25, and, after caulking and painting the boat, set out for Igloolik on August 5. We met with no ice until reaching Weeks bay. We were unable to cut across Wordie

bay, and along its shore could make only a mile or two in twenty-four hours. However on August 11 a S.S.E. gale improved conditions, so that we were able to get to the south point of Straits bay two days later. There we were held up until August 19, the bay being blocked almost to the head. Most of the southern part of Clarke Sound was also blocked, and though there was sometimes a little water on the east side, it was impossible to cross to it. I think the ice again filled Wordie bay soon after we had passed when some of that which was blown into Clarke Sound by the wind of August 11 gradually moved out. No ice blink was seen outside the Tweedsmuir Islands, but whether this was due to the extent of the land or to water I could not be sure. We finally crossed Straits bay on August 20, and after that met only scattered pieces of ice in Clarke Sound. Piling also was clear of ice except for a little in the south-east corner of the bay.

At Piling a letter was found from Baird replying to one left there by us in February 1939. He had also left a sketch-map of the north coast of Foxe Basin which proved very useful to us during the continuation of our journey to Igloolik. He had arrived only a fortnight after we had left and travelled inland some distance in an attempt to cross from Piling to the east coast.

There was a little ice on the south-east point of Baird Peninsula, and between Bray Island and Harbour bay there was very heavy ice; but with the falling tide it moved sufficiently toward the west to allow us to get round its eastern end. Close to the shore however there was open water, as the strong tides seemed to hold the ice in a solid string in the centre of the straits. In the large bay immediately east of Cape Jensen, there was much ice, but it was fairly loose, and we were able to cross almost direct. Steensby Inlet and the straits between Koch Island and Cape Jensen were also filled with fairly loose ice.

We crossed to Koch Island on August 29 and mapped its east coast, but being blocked by ice near its south point, we turned back, and after mapping the north coast, crossed to Jens Munk Island. However owing to an error either in our assumed compass variation or in the map, I think the latter, we found ourselves in Murray Maxwell bay instead of to the south of Jens Munk Island as we intended. After being held up by storms for a few days at the western entrance of the bay, we crossed to Igloolik on September 4.

We had intended to go out on the Hudson's Bay Company's schooner *Fort Severn*, which arrived on September 6, but as she could not take our boat, and as we were unable to sell it at Igloolik where the Eskimo have not yet started to use petrol engines, we decided to continue down the coast of Melville Peninsula in the *Polecat*.

The east coast of Melville Peninsula was mapped by Parry (1824). In 1936-37 we had found the southern portion of his map to be very accurate, and I assumed that the northern part would be equally good. Hence, as the season was getting very late and we were anxious to reach Churchill before freeze-up, we decided to do no mapping. This decision we later regretted when we realized the inadequacy of existing maps between Igloolik and Elizabeth Point, particularly around Parry bay. The maps of both Hall (1879) and Mathiassen (1933) show some improvements on that of Parry, who was too far out when passing this coast to make the careful survey he

did farther south. We did map a small portion of the coast between Cape Wilson and Elizabeth Point.

In order to save gasoline, we sailed about two-thirds of the way south and, being delayed by a rather stormy autumn, did not arrive at Cape Fullerton until October 13, when the small bays were already beginning to freeze over. Having no tent, we decided to wait at the disused Police barracks at Fullerton Harbour till the ice had formed across the large inlets, and there was sufficient snow for snowhouse building on or near the sea-ice. We left Fullerton on December 21, and after spending a week at Chesterfield, arrived at Churchill on 19 January 1941, one day before the train, which runs only once in three weeks, left for Winnipeg.

Physiography

Foxe Peninsula.—Geologically, Foxe Peninsula consists of Pre-Cambrian granites and gneiss, the north-eastern portion only bordering on the Ordovician limestone of the Putnam Highland. The most striking features of the peninsula are the ridges which run parallel in an approximately north-west–south-east direction. These ridges, which are clearly shown on Soper's map (1930 *b*, p. 398), are probably caused by a series of parallel faults, and may be connected with the similarly directed ridges which bound the Pre-Cambrian of Southampton Island. Though the similarity is not so striking, it may be pointed out that on the mainland, farther still to the west, the three big inlets of Wager, Repulse through Frozen Strait, and Lyon, are bordered by somewhat similar north-west–south-east ridges of hills, which in places rise steeply to a height of 1000 or even 2000 feet.

Most of the prominent points on the west coast of Foxe Peninsula are formed by terminations of these ridges. Cape Dorchester is no exception, although after about 20 miles this ridge loses its character, and becomes merged in low, broken hills; its greatest elevation is reached about 10 miles to the east of the cape, and is probably not more than 200 feet. The land at the head of both Dorchester and Gibson bays is very similar, and for several miles out there are drying shoals, while at low tide hundreds of large and small boulders are exposed around the shore. Peregrine Point is a little higher than the surrounding country, and terminates in a small bluff some 30 or 40 feet high. Although off this point there is deep water in many places, there are also dangerous shoals.

The most outstanding hills of Foxe Peninsula are in the neighbourhood of Cape Dorset, where Soper (1930, *b*) says conspicuous hills attain a height of 800 or 850 feet. In travelling from Cape Dorset to Pingokjuak hill, we passed through a jumble of hills intersected by valleys running toward the south-east coast. Most of the hills are 500 feet and higher around Pingokjuak. This hill, though probably over 1000 feet and said by the Eskimos to be the highest on the peninsula, is not particularly outstanding. Immediately to the north there is a considerable area of glacial moraines which form low hills rising not more than 50 feet above the general level of the land, itself 300–500 feet above sea-level. The snow had been blown off the tops of these ridges and they appeared to be composed of medium-sized gravel. Rather more than half-way to Finnie bay, the moraines stand out a little sharper, and

there is a slight drop toward the north. These small hills are shown on Soper's map to the west of Scarp lake. Some 10 miles east of Finnie bay there is a fairly steep scarp, although not as well marked as the Western Escarpment to the north of it; there the moraines end, and solid rock once more appears. The Western Escarpment ends near the head of Finnie bay, and the land from there to Cape Weston is low though rocky. Near Nuwata, and for some miles inland, there is a considerable amount of grassland intersected by glaciated hummocks of solid rock.

From Nabukjuak bay in an east-south-east direction, the land is low and flat, and in summer probably largely grass and marshland. Similar land also extends between the eastern head of Gibson bay and the northern extremity of Chorkbak Inlet. Indeed, north of a line from Cape Weston to the north of Chorkbak Inlet, and from there north-east to the Putnam Highland, there are few hills or ridges over 150 feet. Of those that are over this height, the three most prominent are Dorchester, Kokittwa, and Aukbauya, the latter being distinctly the highest. The Eskimo say that there is some very flat land to the east of Pingokjuak hill, but this is probably in the nature of a plateau. Although we passed by it on a fine day, we were unable to identify Aukbauya hill, which might have been any one of several in that ridge. Kokittwa hill is outstanding and easily identified, but is shown on Soper's map as rather too far to the south-west.

The hills to the west of Chorkbak Inlet are rather similar to those north of Dorset, and of about the same average height, though for the most part somewhat steeper, and cut by deeper valleys which also run toward the south-east. On the east side of the northern arm of Chorkbak Inlet, the hills are probably higher and to the east-north-east also the land is quite hilly.

Putnam Highland.—The main characteristics of Putnam Highland have been previously described by Gould (1928 *a* and *b*) and Soper (1930 *b*). It consists of horizontally bedded Ordovician limestone. Its northern edge terminates in a steep mesa-like front, but at its western side the slope is more gradual. From that side there would be no difficulty in sledging to the top of the plateau which is fairly level and rises gently toward the centre. In February it had a good covering of snow, and the steep-sided gullies of the northern side do not appear to run above a mile or two into the plateau.

In a gully, probably the most westerly on Gould's map (1928 *a*, p. 34), near the north-west corner, there is a small granite exposure underlying the limestone at a height of about 300 feet. The actual junction was concealed by snow and limestone detritus, but 40 yards across the gully the granite is faced by the limestone which there has a steep dip to the north-west, that is to say, toward the granite. However, 50 yards up the brook as elsewhere, the bedding is horizontal, so that the dip is probably due to local subsidence.

We saw a small exposure of limestone *in situ* about 8 miles in a straight line from the mouth of the Aukbauya river near a place for which Soper gives a height of 60 feet. This low extension of the limestone of Putnam Highland probably reaches a further 4 or 5 miles down the river to where some small granite ridges begin. South-east of Bowman bay the limestone may reach the coast, but along the north-east side there are crystalline rocks bordering the shore for several miles, though the limestone is continuous to the east of these

ridges and those near Bluegoose river, and reaches the shore of Bowman bay on the north side.

About 2 miles to the east of the above-mentioned gully, I saw several vertebrae, two ribs, and a few other bones of a Greenland whale partly buried in the disintegrated limestone at an altitude of about 300 feet. No sign of habitation could be seen near by, and they most likely date from a time when the sea-level was very considerably higher.

Great Plain of the Koukdjuak.—This name is used by Soper to describe an area of about 5000 square miles bordered in the north and east by Soper Highland and Nettilling lake, and in the west and south by Foxe Basin and Putnam Highland. It is not a river plain in the true sense, since the rapid-flowing Koukdjuak is a young river which has cut its course, or rather, has followed the retreating sea in the straightest possible line.

On the east shore of Bowman bay, there are a few smooth, glaciated ridges rising to 12 or 15 feet above the surrounding plain, but from there to the north end of Taverner bay, the monotonous, flat, grassy marshland is broken only by scattered erratic boulders which line the coast. These are less numerous inland, perhaps because the smaller ones have sunk into and been covered by the marsh. From a mile or two offshore, where at high tide there is only 3 or 4 feet of water, the coastline appears only as a line of boulders, the height of which is greatly exaggerated by mirage. Along most of this coast, the spring tides penetrate about a mile farther inland than the neap, and a very short, close grass grows on a border of land several hundred yards wide that is covered only by the higher tides. This border in summer time is a favourite feeding ground for both geese and caribou. Towards the sea the grass gives place to a fine, gritty mud. This mud has a firm, cracked surface where it is seldom flooded, but is soft and sticky below the level of the spring tides. In many places farther out still, mud has either never formed, or has been washed away by the tides, leaving limestone gravel, and perhaps some limestone *in situ;* at least when sounding with the boat-hook, we struck places that seemed like solid rock. The sea-bottom, like the land, is quite flat, and the water is very muddy.

Inland the long, waving grass which is predominantly brown in the summer, might, from the distance, be a summer hayfield, but closer inspection shows that the long stalks are widely scattered except in some marshy areas. North of the Koukdjuak there are few tussocks within 5 miles of the coast, but beyond this both the size and the proportion of the area covered by them gradually increases. A suggested explanation is that at this distance from the coast the land may be from 10 to 20 feet above high-tide level, while land below this has not been sufficiently long uncovered by the retreating sea for tussock formation. I saw no tussocks south of the Koukdjuak river, but the farthest I went inland was 5 miles.

Not all the Great Plain of the Koukdjuak is flat grassland. Twenty miles east of the small granite ridges on the shore of Bowman bay is the first of a series of abrupt ridges from 10 to 20 feet high. These are composed chiefly of small limestone gravel. At first they are about 6 miles apart, but toward Cone hill become more frequent. This hill, though it rises only 50 feet above its surrounding ridges, is visible from 20 miles west; from the east it is less

conspicuous amongst the undulating ridges that have a maximum height of 20 feet. About 12 miles to the north-east is a slightly lower hill that extends as a pronounced ridge a little to the west of Cone hill. A few hundred yards beyond Cone hill, limestone is exposed *in situ* where a small brook has cut a gorge. Cone hill and the ridges surrounding it have a distinct resemblance to the Nuvudlik (The Points) on Southampton Island (Manning 1936, pp. 236–237), but I could not be sure of their structure. Farther east, towards a hill that may be identical with Soper's Pingualuik (1928, p. 23), the ridges become more pronounced, rising 40 or 50 feet above the general level. Although these ridges are almost certainly glacial moraines, being composed of small granite boulders, along the bank of a small brook 4 or 5 miles away there is an exposure of limestone *in situ*.

North-east of Pingualuik (?), the land slopes away toward Nettilling lake, and a mile past the brook, drops 100 feet to flat land that is only 20 feet above the surface of the lake. All the west shore of Nettilling lake south of the Koukdjuak is low, and probably consists largely of grassland interspersed with limestone gravel ridges (*cf.* Soper 1928, p. 18).

From what I have said above, and from the remarks of Soper (1928, p. 18) and Hantzsch (Anderson 1930, pp. 121–124) concerning the upper portion of the Koukdjuak river, it seems probable that the marsh land nowhere reaches more than 20 or 30 miles inland from Foxe Basin without being to some extent intersected by low, disintegrated limestone ridges.

Nettilling lake to Pangnirtung.—The east shore of Nettilling lake is composed of granite ridges, some points of which may rise to 200 feet above the lake. After passing Magnetic Point, the shore falls away to the south, and the land is much lower though probably rocky for some miles inland, so that from a distance, at least in winter, the lake seems to extend farther in that direction than toward the east, where it is blocked by islands. The channels between the eastern islands are very tortuous and narrow, although there may be wider passages that we did not see; but farther east they broaden and the height of the islands increases from a maximum of 30 feet to well over 50 feet. The mainland also becomes higher until at the extreme eastern end of the lake, some of the higher hills reach a height of about 500 feet above the lake (*cf.* Soper 1928, p. 15) which is itself 103 feet above sea-level (Weeks 1927, p. 89c).

The route from Nettilling lake to Nettilling fjord lies along a chain of lakes, most of which discharge into Nettilling lake by a small river which was open in places in February 1940. Boas (Millward 1930, p. 19) in 1883, was the first white man to traverse this old Eskimo route, which since that time has so frequently been used by the R.C.M.P. patrols and others. It has been described and mapped by Hantzsch (Anderson 1930), Weeks (1927), and Soper (1928). According to Weeks (p. 87c), the greatest height of the pass is only 30 feet above Nettilling lake. Except that the hills become rather higher and perhaps more rugged, there is no great change in the character of the landscape between the east end of Nettilling lake and the mouth of the fjord.

Some miles to the south of Imigen, the distant mountains of Cumberland Highland appear, dwarfing the hills to the north-west of the Sound. Mount

Duval, which is immediately behind Pangnirtung settlement, is 2300 feet (Soper 1928, p. 4), but most of the surrounding hills are considerably higher. I climbed one to within about 250 feet of the summit, obtaining an aneroid height of 4150 feet. Some of the peaks that could be seen from there were slightly higher.

Soper Highland.—The surface of Soper Highland, like that of Putnam Highland, is composed of disintegrated limestone, chiefly in the form of gravel. Between the ridges, which are almost bare of vegetation, there are some areas of semi-marsh and grassland, though I doubt if these occupy more than half the total area. From the north, west, and south, the plateau rises from the flat land in a series of benches, their faces having an angle of about 45°, with occasional small cliffs where solid limestone is exposed. Unfortunately the cliffs on the west side were covered with snow until August, after which I did not have opportunity to visit them. I did however collect fossils from a very small exposure where a low spur reaches the coast near the north end of Taverner bay. The edge of the plateau at the northern part of the eastern side is quite abrupt, but farther south is covered by gravel mounds that are probably glacial moraines.

The disintegrated limestone ridges along the west shore of Nettilling lake, the limestone *in situ* in the bed of the Koukdjuak river (Soper 1930 *b*, p. 418), at Cone hill and near Nettilling lake, as well as the frequent occurrence of limestone gravel near low-tide mark from Cape Dominion to the north, leaves no room for doubt that the limestone of Soper and Putnam Highlands is continuous beneath the intervening marshland. Indeed, it is hard to account for the unbroken flatness of this plain unless it is assumed that it rests on a horizontally stratified surface.

The coast from Taverner bay to Piling.—The coast from Taverner bay to Hantzsch river consists of low hills of crystalline rocks, chiefly red granite, rarely exceeding 60 feet in height. Inland, the ridges are interspersed with grassland, but this reaches the shore in only two places south of Hantzsch river. On the north side of the river the hills are rather higher, and end abruptly at the coast, forming in places small cliffs. At the north end of Hantzsch bay the edge of these hills swings inland, and the coast is again low, resembling the land on the south side of the river. At the heads of Weeks and Wordie bays higher land almost reaches the shore. At the latter place, Nichols Bluff is distinguished by a band of white quartz visible for several miles. North of Wordie bay the hills become a little higher, particularly around the shore of Straits bay. At the head of Piling Inlet, particularly to the south-east, there is a considerable amount of flat land. Longstaff Bluff at the north point is probably 800 feet high, and is clearly visible from the coast 30 miles south. From its top there is an uninterrupted view of the whole of Piling Inlet and the land to the south-east. The south-west point of Baird Peninsula can also be seen, but the coast to the north is hidden by slightly higher hills.

The central portions of the two larger Tweedsmuir Islands are high, and rise steeply from Clarke Sound, but there is low though rocky land at their north and south ends, and also perhaps on their west sides. The other islands of this group are lower, particularly the two farthest to the south which we did not visit.

The behaviour of both ice and tides in Wordie bay suggests the probability of islands farther south than any I have shown on the present map. The first time I was on Parry Point I was almost certain there was land some 30 miles due west. When I was again there however conditions were not favourable for observations. If there are islands to the south and west of the Tweedsmuir Islands, there may be some connection between them and the Spicer group, since Bartlett (Putnam 1928, pp. 23–24) has shown that these must be either north or east of their charted position, and an error in longitude is the most likely, especially with Cape Dorchester itself then shown as over 10 miles too far to the west.

Geologically, the country from Taverner bay to Piling is rather uniform, consisting of red granite and gneiss, the former being rather more predominant than on Southampton Island. So far as we could determine, the Tweedsmuir Islands are of the same rock as the mainland opposite them, with the one exception of the western part of Anderson Island, which is of limestone. Some of the islands at the entrance to Straits bay, and perhaps parts of Longstaff Bluff, are of very fine-grained dark-grey rock, which in the islands is cut by numerous dykes and veins. A specimen from one island was identified as an altered sediment, and from another as probably an altered volcanic rock (Weeks 1941).

On the landward side of a line well outside the south point of Taverner bay to Point Figgures, there is little or no water at low tide, and in many places shoals show considerably farther out. From Point Figgures a long shoal, part of which dries at low tide, runs out toward the west for at least 6 miles.

Between Taverner bay and Piling the water is deeper and for the most part clear, so that the bottom can be seen at a depth of 20 feet or more. In some places the shore between high and low water is nearly perpendicular; in others there may be a quarter of a mile of reefs, mud, and boulders exposed at low tide. Sand and small pebbles are rare, and occur only on steep beaches. Reefs are very frequent in all the bays, and much of the north side of Wordie bay is rather shallow.

Even in the deepest channel of the narrows in Clarke Sound there is probably not more than 5 feet of water at low tide, and I think it not unlikely that the channels between the small islands to the west dry completely at low tide, possibly joining the two largest Tweedsmuir Islands. The water of Piling bay, especially near Longstaff Bluff, is very turbid, and has a blue-grey colour quite distinct from the grey-brown of the water bordering the Great Plain and other limestone areas. This colour is probably due to the decomposition of the rock near the bluff which is a dark grey, fine-grained schist.

From a hill 6 or 7 miles to the north of Piling, I saw what I took to be an ice-cap about 20 miles farther to the north, and a like distance from the coast.

Baird Peninsula, Bray Island, and Koch Island are all limestone. The highest point is on Bray Island, but even that is probably not over 100 feet. A few exposures of solid limestone in sea-cliffs about 15 feet high containing fossils were found along the south-east shore of Baird Peninsula. Elsewhere only disintegrated limestone was seen, but doubtless further exposures would be revealed by detailed search.

The water along the shore of these islands was everywhere very shallow, and at the south-east point of Baird Peninsula the tide goes out about 2 miles. The strait between Baird Peninsula and Bray Island is shallow, and great care would be needed to pass through even with a small schooner. Off the south-east side of Bray Island there is a particularly large shoal, which at low tide is studded with large boulders protruding above the surface. Between Bray Island and the mainland the water is comparatively deep, and on the north side Harbour Bay forms an excellent, well-sheltered harbour.

The rock on the east side of Harbour bay closely resembles that on the north side of Piling. It is intersected by a few quartz dykes, and has a marked cleavage with a dip that is usually nearly vertical, and an approximate north–south strike. Weeks (1941) identified a specimen from there as sheared greywacké or other similar sediment. On the west side of Harbour bay, the rock changes to the more usual granite and gneiss, and continues thus to the big bay 8 miles to the west, on the east point of which is a large quartz dyke containing amethyst. The rock of the islands 1, 2, and 3, in this bay resembles that of the east side of Harbour bay. At island 3 there was a peculiar deviation of the compass, and angles taken from the summit in a northerly direction gave readings of about 40° in excess of those taken in the boat a few hundred yards away. Cape Jensen is granite and about 400 feet high.

Rowley Island was only seen in the distance. It appeared rather higher than the other limestone islands. One hill with a fairly steep northern slope which could be clearly seen from the top of Cape Jensen was probably about 200 feet high.

The eastern entrance of Murray Maxwell bay is shallow, with scattered shoals in many places not more than 8 feet below water at low tide. Just inside this entrance is an island about 300 × 400 yards in area, and 25 feet high, composed of marine or estuarine silt with fossils. The silt is covered with 3 or 4 feet of seemingly unstratified material containing numerous boulders, presumably a glacial deposit. The complete erosion by the sea of the soft silt has been prevented by a rampart of boulders fallen from the upper layer. The eastern half of the northern shore of Murray Maxwell bay is very low and composed of limestone, as is the greater part of Jens Munk Island. On the northern shore of the latter the crystalline rocks do not begin before the immediate vicinity of the narrows, although extending some distance farther east on the south shore. A description of this area is given by Mathiassen (1933, pp. 24–30).

Rivers.—The Koukdjuak is only 2½ feet deep at its mouth, but it is fresh for 2 or 3 miles out to sea. Seven miles from the mouth it is a little over a mile wide, with a central depth of 8 feet from which it shoals gradually toward the sides, for it has no banks. Below this at least, there are no rapids, and the current is swift, probably 6 m.p.h. in the centre. Thus the average flow of water may be around 140,000 cubic feet per second, though this estimate, like the one given below for Hantzsch river, is very approximate. The bed of the river, which can be seen clearly through the crystal water, is composed of limestone pebbles, with some crystalline rocks and an occasional large boulder. In August, the pebbly ground extended for some 300 or 400

yards on either side of the river. This I first thought indicated high spring floods, but when I visited the river on 26 June 1940, the water was not noticeably higher, though the smaller brooks to the north, which would later be only a few inches deep, were then 3 or 4 feet in depth. It is possible that the low level of water at that time was due to an ice-block farther up, especially as the centre of the river was still full of stationary ice. But there is another explanation: at several of the islands toward the east end of Nettilling lake during the preceding winter, the ice had sunk about 3 feet since forming. Unless this apparent drop was due to the pushing up of ice around the shore, and I do not think it was, the same condition must have existed elsewhere on the lake; it would be quite possible for this to have been concealed by the large snowbanks around the shore. It is quite normal for the surface of lakes from which large rivers flow to sink during the winter. The amount they sink depends chiefly on the depth below the lake surface of the bed of the outflowing river. Thus the lake nearest the mouth of Hantzsch river had dropped by 6 feet by the beginning of November. If the level of Nettilling lake had dropped 3 feet during the winter, it would absorb the equivalent of 5 or 6 days' normal flow of the Koukdjuak before reaching its normal level, and an equivalent of 2 days' flow for every further foot of fall. This, together with the water that might be held up in Amadjuak lake by the same cause, would materially delay and reduce the flooding of the Koukdjuak.

Hantzsch river is about 200 yards wide at the first rapids which begin at the tide limit. I should estimate its flow in late August as 25,000 cubic feet per second. In the spring this would be doubled at least, perhaps trebled, since the first lake upstream overflows to the south forming a second channel with a stream almost as large as the first at normal times. That such flooding should come with the melting snow of spring is not strange, but I was surprised to find it had subsided so little as late as July 27 when all but a few of the largest snowbanks had vanished, and the smaller brooks were nearly normal. The following year however after a much drier summer, there was no flooding when we saw the river on August 5. The two tributaries of Hantzsch river that we followed rise in rough, rocky hills. In late March the most northerly, though only a small stream, was not frozen where it flowed from a small lake beyond which we could not trace it. There were also two other unfrozen places farther down the stream where it flowed west before leaving the hills. On April 3, that section in places was flooded 2 or 3 feet deep. This was doubtless caused by the warm weather, but the open places did not appear to have been frozen during the winter. The river leaves the hills where an abrupt scarp running from the north terminates in a jumble of hills. From there to the mouth it passes through a number of small lakes often separated by rapids and in some places where the land is low breaks up into several channels which later rejoin.

If there are any other large rivers on this coast south of Piling, I think they must flow either into Straits bay or the north end of Wordie bay. Between Hantzsch river and Wordie bay the lack of even small brooks is rather remarkable.

The brook that flows into the south end of Wordie bay was flooded several times between freeze-up and the middle of December in 1938. Near the end

of that month we were unable to trace its course past a lake some miles inland. To the east of there the country consists largely of glacial moraines among which it is often difficult to follow brooks in winter. A brook reaching the sea just south of the south point of Straits bay was a little bigger than this, and one to the north of there which we heard but did not see, may have been about the same size.

Some of the brooks running off the flat land south of Taverner bay have, like the Koukdjuak river, limestone beds and no banks; others, notably the two at the south end of Taverner bay, have well-defined banks, in places at least 5 feet high. Probably these banks only form when the limestone is covered with a layer of clay or mud, for although the bed is usually of limestone, the banks are of clay. At the north end of Taverner bay where the first few granite ridges begin, the spring tides flood a considerable amount of grassland behind them, and a peculiar system of channels with muddy bottoms has developed. These average 4 feet deep and 7 feet wide, and run several hundred yards into the grassland.

Eskimo

The Eskimo of Foxe Peninsula belong to the Okomiut group which inhabits all southern Baffin Island. Foxe Peninsula is a good fox country, with the result that the natives are said to be better off there than at other places along Hudson Strait. The Eskimo on the west coast can usually obtain walrus at Cape Dorchester in the spring, and those on the south, at Nottingham Island toward the fall. The doubling of the price paid for foxes consequent on the establishment of a trading post of the Baffin Trading Company at Cape Dorset, has also helped the natives, at least temporarily. The kayak is still used for summer seal hunting, but the umiak has given place to the wooden whaleboat. Perhaps fewer Eskimo on Foxe Peninsula than on Southampton Island have gasoline engines, but there are at least two fully decked Peterhead boats with engines.

A party of Eskimos from Cape Dorset spent the winter of 1937–38 at the south end of Nettilling lake, but during the following winter a shortage of game forced them to move to Cumberland Sound. In the summer of 1938 a caribou hunting party from Cumberland Sound reached Taverner bay, but although they regularly hunt the eastern end of the lake, it is unusual for them to go to the west side, and I know of no recent occasion when they have wintered on the lake. Boas (1888, p. 430) says that it was at one time the custom for a number of families to winter on the lake, but they had not done so since 1878. Soper (1928, p. 17) mentions that once there were three or four regular camping places on the lake.

The natives who live along the north shore of Foxe Basin are either Iglulingmiut, or the closely related Aivilingmiut who moved north from the region of Repulse Bay about 1936. There may also be a few of another closely related group, the Tununermiut, from the Pond Inlet district.

The eastern end of Fury and Hecla Strait is perhaps the best walrus district in the Eastern Arctic, and this has attracted a rather large number of Eskimo in spite of the fact that until the Hudson's Bay Company's post was established on the island, they had to go to Pond Inlet, Arctic bay, or Repulse

bay to trade. The remoteness of these trading posts and the consequent impossibility of visiting them more than once a year has made the Iglulingmiut less dependent on outside supplies than some Eskimo, although many of them may have visited the whalers at Repulse bay and Pond Inlet, or traded with them indirectly through the Aivilingmiut and the Tununermiut at least as early as 1870. The Iglulingmiut, like the Aivilingmiut, never used the umiak, and they have now ceased to use the kayak. In 1940 quite a number of them had whaleboats, but not gasoline engines.

Owing to the absence of game in the winter, and the difficulty of seal hunting on such a flat coast in the summer, it is very unlikely that the coast between Bowman bay and Taverner bay has ever been inhabited by other than summer hunting parties. Between Taverner bay and Piling, evidence of former occupation is frequent. This chiefly takes the form of small beacons which, in some places, occur by the hundred, and must have been used in hunting caribou. There are also tent rings and other structures. The only historical reference to permanent inhabitants of this coast is from Parry (1824, p. 430), who speaks of a party of Eskimo coming from "Pulig" (Piling) to Igloolik in 1823. Hall (1879, pp. 354–356) records the account of a woman who travelled with a party from Northumberland Inlet (Cumberland Sound) to Igloolik by way of "Kouk-ju-a" (Koukdjuak) and "E-pe-u-tin" (Isthmus of Baird Peninsula). Boas (1888, p. 432) was able to learn of only four expeditions from Cumberland Sound to Igloolik, the first in 1750, and the last in 1835; all member of the latter perished on "E-pe-u-tin." He therefore considered there was little intercourse between the natives of Cumberland Sound and those of Igloolik, but the numerous beacons all the way up Hantzsch river to the eastern end of Soper Highland, indicate frequent contact with Nettilling lake, and Boas (1888, p. 444) mentions the meeting between Cumberland Sound Eskimos and Pilingmiut in this region. The Pilingmiut, if not just Iglulingmiut residing at Piling, were closely related to them, as is apparent from Parry (1824, p. 549). Since the last party of Cumberland Sound natives died near Piling, it seems not improbable that there were no permanent inhabitants there at that time. Hantzsch saw no recent sign of natives on the west Baffin coast.

We saw no Eskimos living between Cape Dorchester and Harbour bay, but we heard at Igloolik that one party of natives had spent the winter of 1939–40 in the neighbourhood of Piling, and I have since heard that some of these visited Dorset last spring, perhaps attracted by the high price of fur to be obtained there. Thus this coast may once more be occupied, and as both bearded and ringed seals are fairly plentiful during the summer, and caribou are probably more numerous there than elsewhere on Baffin Island, it should be a good hunting district, at least until the caribou have been killed off or driven back into the hills.

The Iglulingmiut told Parry (1824, p. 303) of a group of Eskimos, the "Seăd-lēr-mĕ-ŏo" (Sadlermiut) who inhabited an island a great way to the east or north-east of Igloolik, and with whom they had no intercourse. These people, Parry (p. 549) considered to be the inhabitants of the eastern coast of Baffin Island, and assumed their name was a general term for any strangers. Doubtless he was led to this assumption because the name was used for the

inhabitants of Southampton Island with whom the Eskimo of the mainland also had no contact, and of whom he had heard while at Winter Island. These Southampton Islanders were called Sadlermiut by the mainland Eskimos from the name of the island, Sadleq. Father Ducharme, who has spent some twenty years at Chesterfield, tells me that the meaning of Sadleq is "that which is over there," and has no connection with the fact that the people were strangers. Boas (1888, p. 665) translates it "the island nearest the sea," which, though quite different if taken literally, has, in this case, the same general meaning. Since Rowley and Bray Islands are called Sadleq by the Iglulingmiut, it is likely they were the home of Parry's Seăd-lēr-mĕ-ŏo. Parry's supposition that his informants were referring to the people of east Baffin Island is disproved by the fact that Boas (1888, p. 444) learned of the approximately correct position of the Sadleq Islands, though nothing about the inhabitants, from the natives of that coast. Parry himself saw Rowley Island in the distance, but does not appear to have learned the Eskimo name for it, and it is not shown on the maps drawn for him by the Eskimos. Possibly it was deliberately omitted for superstitious reasons. An independent name group of Eskimos originating from islands so small as the Sadleq Islands leads to the interesting speculation as to the existence of further islands to the south of them. It is of course possible that in 1822 these Sadlermuit were already extinct, or that they were a semi-mythical race. This can now be settled only by archeological exploration.

APPENDIX

Notes on tides along the east and north shore of Foxe Basin

The figures for the tidal observations given below are from estimation only, and are very approximate.

Strong tides are to be expected around Cape Dorset, and those of Mill Island have given cause for remark since the time of Baffin, but we were surprised by the distance these strong tides extend up the coast. It was spring tides when we passed between Cape Dorchester and the islands, 3 miles to the north, and a few scattered pieces of ice were being driven in all directions with such a speed that we were forced to wait for slack water. At Peregrine Point the tides were still strong, but between there and the north end of Taverner bay, the tide running parallel to the coast was apt to be confused by the very strong tides which ran out of the shallow bays, particularly Bowman bay, or off the very flat coast to the north of there. Along the steeper coast north of Taverner bay, the tides running parallel to the coast were again well marked, with occasional tide rips in shallow places and at the points. The speed reached being rather more than 2 m.p.h. at maximum flow over the whole distance between Taverner bay and Wordie bay.

The rise and fall of the spring tides at Hantzsch bay was about 25 feet, probably at least as large as at Cape Dorchester. At the south end of Wordie bay however this rise and fall is only about 12 feet or less. There also, although there was no actual double tide, a marked pause in the rise and fall was noticed. At Parry Point the flood set from the south into the bay, perhaps reaching a speed of 1 ½–2 m.p.h.

On the southern side of Straits bay between the south point and the first island, the flood still comes from the south, and flows into the bay at considerable speed, perhaps 3½ m.p.h., this speed being due to the narrow, island-

blocked entrance. The rise and fall here seemed to be rather higher than at the south end of Wordie bay; also, the pause noted at the latter place was not observed. At the southern end of Clarke Sound the tide fails to reach a speed of more than ½ m.p.h. I believe the flood that enters the north side of Straits bay comes from the north, and I am certain that this is the case in the narrows at the centre of the sound where the tide reaches a speed of about 8 m.p.h. The time of high tide 3 miles to the north of the narrows appeared to be 5 hours earlier, or perhaps more correctly, 7 hours later than at the south point of Straits bay. However, it was very dark when this observation was made.

At Piling the flood tide comes from the west, and this also seemed to be the case at the south-west point of Baird Peninsula, where it may have reached a speed of 1½ m.p.h. At the latter place the rise and fall of spring tides may amount to 15 feet, probably being rather less at Piling and Cape Jensen. Between Bray Island and Harbour bay the flood sets from the west, and this tide goes at least some distance down the east shore of that island. At the north-east point of Bray Island high tide is about 3 hours later than at the south-west point of Baird Peninsula.

On the east coast of Koch Island the flood appeared to set from the south, but it is not very rapid, nor is there much tide between that island and Cape Jensen. There is a very rapid tide, perhaps 6 m.p.h., in the narrow entrance at the west end of Murray Maxwell bay, the flood entering. The rise and fall just inside the bay was only 4 feet at spring tides.

In Fury and Hecla Strait the flood comes from the west, and the ebb in the narrows, according to Parry (1824, p. 337) is often imperceptible owing to a strong permanent easterly current, at least in summer. At Igloolik we found the rise and fall to be about 6 feet at neap tide, and it was about the same at Cape Jermain. Parry (1825, pp. 151–182) gives for the former place a maximum of 9 feet 8 inches, and a minimum of 5 inches for observations conducted throughout the winter 1822–23.

Compared with the west Baffin coast, the tidal currents along the east coast of Melville Peninsula are, as a rule, not rapid. According to Parry (1824, p. 478) the flood sets from the north, being aided by a marked current from the same direction which counteracts the ebb; but some 30 miles south of Igloolik we noticed a strong tide setting toward the north, at least near the shore, when the tide was thought to be rising.

Summary of ice conditions

Summer.—According to native report the west coast of Foxe Peninsula is usually free of ice by the middle of July. Foxe makes no mention of ice along that coast. Parry (1824, pp. 482–483), after pointing out how the ice hugs the coast of Southampton Island and southern Melville Peninsula, suggests that the same clear water that he found between that ice and the Trinity Islands, would extend some distance to the north of Foxe's Farthest (66° 50′). The accounts of Captains Spicer and MacKenzie (Wakeham 1898, pp. 54–61), and more recently of Captain Bartlett (Putnam 1928, pp. 22–24) seem to support this. Putnam (1928, p. 21) however mentions heavy pack-ice at the northern end of Foxe Channel towards the end of August, and also a considerable amount along the shore between Cape Dorchester and Bowman bay during August. Soper (1930 *b*) makes no mention of pack-ice on his journey to Cape Dorchester in August 1928, but in 1929 between Bowman bay and Gibson bay, he was continually blocked by ice; he mentions (pp. 423–424) that his Eskimos considered this more normal than the comparatively open conditions which were met with

by Putnam. However, the season was still early when Soper left Foxe Basin on August 11.

At Cape Weston we met a small amount of ice which was perhaps local. There was then no ice until west of Gibson bay, and we left this directly we turned north, so it may have been only a band extending along the coast. Hantzsch (Anderson 1930, p. 124) says that there was ice lining the shore at the mouth of the Koukdjuak river in mid-September, 1910, but it does not appear that he was referring to other than stranded ice, or perhaps young ice then forming. We had only one opportunity of observing conditions south of the Koukdjuak river, but our three years' experience along the coast to the north seems to show that the ice there moves away from the shore rather early, perhaps under the influence of the strong tides, and that once gone, it does not return. I am inclined to think that in most years, although there might be ice along the north shore of Foxe Peninsula, the east shore of Foxe Basin could usually be approached from the west in the vicinity of Taverner bay by the end of August.

Farther north, around Wordie bay, conditions were very different. Not only was the bay full of ice both years we were there, but after being blown out by a strong offshore gale returned, helped only by the gentlest of winds.

Ice conditions between there and the west of Murray Maxwell bay I have already described in the narrative section. Our observations relate to one summer only, and except that in 1822 Parry (1824, p. 286) met considerable ice between the Calthorpe Islands and Koch Island, the coast has not been visited in summer by other than Eskimos.

In 1822 Parry had found the narrows of Fury and Hecla Strait blocked by solid ice from shore to shore as late as September 19, when young ice was already beginning to make on the sea. Next year there was fixed ice from Neerlo Nakto across to the entrance of Murray Maxwell Bay as late as August 7, and he therefore abandoned further efforts to penetrate the strait. Hall (1879, p. 349) however was told by the Eskimo that in some years the strait is free of ice. Captain Bartlett is quoted in the *Arctic Pilot* (1931, p. 187) to the effect that the strait appeared quite free of ice on 29 August 1927, and that with sufficient time and favourable weather, a passage would be possible in many years. The *Pilot* however justly remarks that Bartlett was some 50 or 60 miles from the barrier which finally stopped Parry's progress. When we crossed from Murray Maxwell bay to Igloolik we saw only one piece of ice, and the strait was also clear as far to the west as we could see. Although we were never nearer than 40 miles from Amherst Island where Parry was blocked, had there been ice in the strait, it is most improbable that the permanent current coming from the west as well as the strong north-west wind which blew while we were crossing and for the two days we were at Igloolik, would not have brought scattered pieces of ice through unless the strait were actually frozen solid, which I think most unlikely that year. It should be mentioned that we had an exceptional amount of north-west winds during the summer and ice conditions at Igloolik were said to be quite unusual.

Winter.—From Cape Dorchester to the east side of Gibson bay there was little or no fixed ice that did not rest on the bottom at low tide, and which was not in consequence rough. The same would probably be true of the rest of the north coast of the peninsula. From Bowman bay to Taverner bay, the floe edge is surprisingly close to the shore, and bare ground is probably uncovered at low tide in some places throughout the winter. Bowman bay was not frozen over either in December 1939 or early January 1940, and there was considerable open water at the ebb tides both there and farther north.

From Taverner bay to beyond Weeks bay the ice breaks off at the headlands. In the winters of 1938 and 1939 a little smooth ice formed in Hantzsch and Weeks bays, but towards the floe it was very rough. In February 1939 there were large stretches of smooth ice in Wordie bay. It was not until after the middle of December that that bay froze over completely. Then the floe edge curved out to the west from a little south of Parry Point, and passed some way to the south of the southernmost of the Tweedsmuir Islands. In February we saw no sign of water outside these islands, but from Piling water sky could be seen about 15–20 miles to the south-west. In Straits bay the ice was smooth as was most of that in Clarke Sound with the exception of the narrows where there was some ice of the previous year. There were also a few pieces of old ice frozen in at the head of Wordie bay. None were seen elsewhere.

We saw no icebergs either in Foxe Basin or Foxe Channel, and it must have been a very unusual set of circumstances that brought those seen by Captain Bartlett to Cape Dorchester (Putnam 1928, p. 22). As it is now definitely known that there are no glaciers reaching Foxe Basin, they must have come through either Fury and Hecla Strait or Hudson Strait, presumably the latter. Had they been vouched for by a less experienced observer they might have been confused with large pressure hummocks such as two we saw near Parry Point. One of these that lay against the land did not move between September 1938 and August 1940, and had probably received additions for many years. It rose at least 50 feet above low-tide level.

NEW NAMES SUBMITTED TO THE GEOGRAPHIC BOARD OF CANADA

Harbour Bay	This small bay forms a very good harbour which we used in 1940.	
Rowley Island (Esk. Sadleq)	After G. W. Rowley	The first two white men to visit or pass near there.
Bray Island (Esk. Sadleq)	After R. J. O. Bray	
Baird Peninsula (Esk. Satorssuaq)	P. D. Baird mapped part of this in 1938.	
Lake Gillian	Named on sketch-map by R. J. O. Bray in 1937 after his wife.	
Longstaff Bluff (Esk. Kingnakjuak)	After T. G. Longstaff, Himalayan climber and Arctic traveller.	
Anderson Island	After R. M. Anderson, Chief of Division of Biology, National Museum of Canada.	
Tweedsmuir Islands	After the present and late Lord Tweedsmuir.	
Clarke Sound	After L. Clarke, curator of the Cambridge University Ethnological Museum.	
Straits Bay	Bay with narrow entrance off above sound.	
Wordie Bay	After J. M. Wordie, Honorary Secretary of the Royal Geographical Society, and Arctic traveller.	
Nichols Bluff	After D. A. Nichols of the Geological Survey of Canada.	
Point Peters	After F. H. Peters, Surveyor-General of Canada.	
Parry Point	After H. Parry of the Topographical Survey of Canada.	
Weeks Bay	After L. J. Weeks of the Geological Survey of Canada.	
Flood Brook	This brook floods during winter.	

Figgures Point	.. After H. Figgures, Hudson's Bay Company's clerk at Cape Dorset.
Hantzsch Bay ..	.. Bay into which Hantzsch River flows.
Canoe Camp ..	.. No geographical feature here. For convenience of location only.
Pebble Brook ..	.. Exceptionally pebbly.
Soper Highland	.. After J. D. Soper, Arctic traveller, formerly of the National Museum of Canada.

NOTES ON THE CONSTRUCTION OF THE MAP. BY THE EDITOR

The following material has been used:

1. Surveys by T. H. Manning, leader, British Canadian Arctic Expedition. Time and compass traverses plotted on the scale of 1 inch : 4 miles:—

(*a*) Cape Dorchester to east side of Gibson bay.
(*b*) Bowman bay coast to Magnetic Point.
(*c*) Canoe Camp to Cape Jensen.

With astronomical fixes at:

Cape Dorchester	Lat. 65° 25′ 34″ N.	Long. 77° 24′ 10″ W
Magnetic Point	66 19 45	70 36 06
Canoe Camp	66 57 15	72 47 59
Spy hill	67 17 02	72 16 32
Hantzsch river (mouth of) ..	67 31 14	72 25 59
Hantzsch river (upper)	67 27 59	—
Clarke Sound	68 33 12	74 23 22
North-west end of small island ½ mile south of Longstaff Bluff (Kingnakjuak) (Obs. by P. D. Baird)	68 54 N.	75 05 W.
On sea-ice 200 yards from head of north-west arm of Eqe inlet (Obs. by P. D. Baird)	69 44	76 23

2. Unpublished traverse between Cape Jensen and Longstaff Bluff by R. J. O. Bray and G. W. Rowley, British Canadian Arctic Expedition, 1937. Scale 1/250,000, with astronomical fixes at:

Isortoq	Lat. 69° 49′ N.	Long. 77° 14′ W.
Eqe	69 34	
Lake Gillian (island in lake)	69 27	
Ikpik	69 17	

(The Lake Gillian fix is however plotted as 69° 25′ 20″ N., and this has been adopted for the map accompanying this paper.)

3. Surveys by J. Dewey Soper:

(*a*) Map of Foxe Peninsula, 1928–29. Scale 1 inch : 5 miles. (Prepared by the Northwest Territories, Department of the Interior, Ottawa. For details of observations see *Geogr. Rev.* 20 (1930) 397–424.)

(*b*) Map showing route survey to Hantzsch river, 1929. Scale 1 inch : 5 miles. (Prepared by N.W. Territories Dept. of Interior.) Latitudes from this map:

On Bowman bay coast	Lat. 65° 51′ N.
Mouth of Koukdjuak river	66 46 43″ N.
Mouth of Hantzsch river	67 33 31 N.[1]

[1] A mean of this figure and Manning's has been adopted.

(*c*) Sketch-map of Nettilling lake and the Koukdjuak river. Scale 1 inch : 16 miles. (Prepared by Nat. Resources Intelligence Service Dept. of the Interior, Ottawa, and published in 'Southern Baffin Island,' by A. E. Millward.)

(*d*) Sketch-map of traverse from Cumberland Gulf to Amadjuak bay. Scale 1 inch : 32 miles. (Prepared and published as (*c*).)

4. Survey of Head of Cumberland Sound and route to Nettilling lake, by L. J. Weeks. Scale 1 inch : 8 miles. (*Summ. Rep. geol. surv. Can.*, 1927, Part C.) With fixes at:

Nettilling lake (at outlet of lake)	Lat. 66° 22′ 09″ N.	Long. 69° 19′ 14″ W.
Nettilling lake (on shoreline) ..	66 13 35	—

5. Results of the Putnam Baffin Island Expedition, 1927. Map on scale of 1/1,700,000. (*Geogr. Rev.* 18 (1928) 1–40.)

6. Observations made by George Dawson Howell, Jr., on the MacMillan Expedition, 1921–22. (*Geogr. Rev.* 18 (1928) 351.)

7. Position of Schooner Harbour: Lat. 64° 24′ N. Long. 77° 52′ W. (Quoted by Soper in *Geogr. Rev.* 20 (1930) as position of winter quarters of the MacMillan Expedition.)

8. Position of Cape Dorset: Lat. 64° 13′ 52″ N. Long. 76° 32′ 51″ W. (Determined by Mr. Ney of the Geodetic Survey quoted by Manning.)

Manning's Cape Dorchester reductions were checked by Mr. Parry, of the Canadian Topographical Survey, and his position has been accepted for the present map. The longitude observed by Professor Laurence Gould (Putnam Expedition, 1927) is approximately 20′ W. of Manning's position, his latitude agrees within 20″. Gould, who had trouble with his radio, agrees that Manning's position is probably the more correct. Soper concurs in accepting Manning. Howell's station 3 appears a little too far west compared with Manning.

Identifying Gould's first observation east of Cape Dorchester as a point about 3 miles N. of the outlet of the Kommanik river (on Soper's map *a*), Gould's latitude can be used. Fitting Manning's traverse to this adjustment, Howell's two other positions fall in reasonably. Soper's map *a* indicates Camp Walcott of the Putnam Expedition and Gould's latitude is adopted; his longitudes would necessitate unreasonable adjustment to Soper's traverse and have therefore been neglected.

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POPULATION DENSITY IN GREECE

PROFESSOR A. G. OGILVIE

THE effect of the great physical contrasts upon the distribution of the population in Greece has long been noted, but it has hitherto been impossible to obtain any detailed impression of it, owing to the lack of any adequate map of population density, and until recent years also from the incomplete character of the topographical maps. Maps showing population density according to administrative division have been specially unsatisfactory for two reasons, even when on quite small scales. The smallest units for which the boundaries appeared on any reliable maps were those of the departments (*nomoi*) of which there are thirty-seven, varying in size between 288 and 8793 sq. km. The boundaries of these infrequently follow important natural features and in few cases do they mark striking divisions of population density.

It seemed desirable therefore to remedy this defect at the present time, first because a sound basis for study had at last been provided by the completion of systematic surveys covering the greater part of the mainland and some of the islands, and secondly on account of the tragic plight of the Hellenic people and state. When the time comes for the reconstruction of Greece it will surely be important to know how many people were actually being supported on land of various types and in regions of differing accessibility. Furthermore the closest study of the latest official census, taken in 1928, was deemed to be worth while, since it disclosed the manner in which the great floods of immigrant refugees, absorbed by the nation between 1919 and 1923, had affected the distribution of population by that date. In this connection a later census would have been still more valuable since the schemes of land reclamation undertaken by the Government, largely because of the influx of population, were still incomplete.

The map now presented was compiled on the scale of 1/M and is reproduced on 1/1,750,000. The production of maps of population density on the former scale has always seemed to me most desirable, indeed this may very well provide the most fruitful field for international cooperation in cartography after the international map itself. Such maps should be compiled by the geographers of the nations concerned with the respective sheets of the map; and when this is done in Greece it is quite likely that many of the boundaries chosen, with greater local knowledge than I possess, will differ from those here shown. But the basis of my selection and the manner of compilation should now be described.

The map is the result of study of topographical maps, mostly on the scale 1/100,000, and of the census of Greece taken in May 1928. Older and less reliable maps of smaller scale had to be used for Kríti and most of Évvoia: in the case of the former the divisions and the densities are much less reliable than elsewhere. Most of the densities for the smaller islands were taken from the list published in the *Annuaire Statistique de la Grèce*, 1931. Those which bear no figure are believed to be uninhabited.[1]

The first stage in the compilation was the delimitation of areas in which either the economic interests of the inhabitants are similar or the distribution of population is notably uniform. Admittedly the process is subjective, and success depends upon the degree of one's knowledge, whether personal or gathered from reading; but within the limits described below the census proved to be an effective check. The process was easiest in the plains which generally are the most densely peopled regions. The boundaries containing these have usually been drawn not at the edges of plains but on the crests of the enclosing mountains, since the villagers living on the slopes and those on the plains generally have common interests and often depend upon use of the same land. In the mountains, which cover most of the country, the boundaries tend to follow watersheds, but this is by no means universal.

The most difficult decision relates to uninhabited land, and very few areas have been shown in this category, since in Greece there is little ground that is not used for pasture. There is in fact not much to distinguish uninhabited land from that shown as having less than 5 persons per sq. km. At the other end of the scale the inclusion or elimination of the towns from the calculations of density always presents a difficulty. But in Greece the inland towns with few exceptions are devoid of large manufacturing industries: they are the markets of agricultural regions. Therefore only the capital and leading seaports have been excluded and shown separately.

The next stage, which proved to be the most laborious, was the identification on the maps of the communes named in the census. This was difficult for two reasons: firstly, because most of the topographic maps omit the administrative boundaries, sometimes even those of the departments; and secondly, because the nomenclature on the maps in many cases differs from that used in the census. Frequent recourse had to be made to other sources to establish the identity of many places, and even so in many areas a few

[1] On the map the drained lakes Yiannitsá, Arján and Amátovou, and Akhinós, nearest to the population figures, respectively, 67, 34, and 83, in Makedhonía are shown as lakes since they were drained after the 1928 census.

communes could not be located. Here then is an evident source of error which proved to be largest in parts of Pelopónnisos; but it does not represent a difference of more than two or three per cent. in any case, and in most districts the error in density probably amounts to plus or minus one per sq. km.

Having obtained the total population within a given line the final operations were the measurement of the areas and the calculation of density. The measurement was accomplished by counting the 1-km. squares of a grid. This method, while less accurate than using a planimeter, may be regarded as sufficiently reliable in that it was carried out for most of the country on a scale ten times that of the compilation.

The distribution of population density

At the census of 1928 the area of Greece was 130,199 sq. km. and the total population 6,204,684, giving an average density of 47·66 per sq. km. If the populations of the ten cities and towns eliminated from the present calculations, amounting to 1,211,904 or 19·53 per cent. of the total, be deducted the remaining total is 4,992,780 and the average density becomes 38·35. Since the reasons for varying densities among the islands differ considerably from those affecting the mainland it is well to consider separately the facts about the latter, while recognizing that they may be expected to apply also to Kríti and especially to Évvoia. The islanders numbered 1,122,902, omitting the population of Khalkís and two towns in Kríti, or nearly the same total as already deducted and comprising 18·08 per cent. of the population of Greece. There remain 3,869,878, over three-fifths of the total, inhabiting the mainland apart from the said towns and occupying an area of 107,878 sq. km., the average density being 34·95. Not many of the districts here delineated have densities approaching this figure; only about one in ten of the areas have between 30 and 40 per sq. km.; these are widely scattered and belong to many different physical types of land.

It is more interesting to examine the populations supported respectively upon mountain and plain, since the Greeks are known on the one hand as mountaineers and on the other, as a people whose ancient culture developed chiefly upon the many small plains in which the country abounds. Such an examination becomes worth while with the dividing lines drawn very largely upon a physical basis. Fifty-nine districts are regarded as plains, including in most cases the slopes facing them; they are distinguished on the map by double boundary lines and by the use of italic figures of density. The remainder are regarded as mountainous, whatever the altitude, provided the relief is generally so rough as to offer a small proportion of cultivable land. In only a few cases is there any difficulty in deciding to which category districts should be assigned. The aggregate area of the plains is some 33,000 sq. km. or about 30 per cent. of the mainland. Their population is some 2,027,000 or about 52 per cent. of the total for the mainland apart from the eliminated towns. Thus it is a safe generalization to state that over one-half the rural population lives upon plains comprising less than one-third of the mainland. But it is just as important to stress firstly, that nearly half of the people live in a mountain environment; and secondly, that the plains which

usually contain the regional and local capitals are widely scattered among and around the mountains.

Population of the mountains

By far the largest continuous area of small population lies in north-western Greece and marks principally the high dividing ranges of the Píndhos system; but this relatively empty region, with its characteristic densities between 10 and 20 per sq. km., extends eastward to the plateaus of Attikí, corresponding to high and arid limestone surfaces throughout central Greece. The low densities of 8, throughout the culminating area of Píndhos, and 6 on the Grámmos mountains to the north represent the permanent inhabitants at high altitudes, since the census was taken before the arrival of the shepherds on the summer pastures. This factor should be remembered in other high mountains as well. Because of their widespread use for pasture very few areas of mountain have been shown as uninhabited. The distinction of these is somewhat arbitrary, but the patches are more numerous in southern Greece on account of the bareness of the high crests there. On many other mountain groups the density has been shown as <5, to indicate an estimate. The lines on the Píndhos and flanking mountains have been so drawn as to bring out the greater population in three transverse belts where the valleys lead to the main passes, *e.g.* density 37 in the corridor crossing the Métsovon pass between Thessalía and Ípiros.

Another large mountain region with sparse population is the Greek part of the Rodhópi highlands in Makedhonía and Thráki, where throughout a strip 290 km. long the densities vary from 3 to 29. Within these limits the variation is affected by accessibility to the plains, by possible insecurity near the frontier, and by poor communications within the mountains: the last notably north of the canyon of the Néstos where the density is 5. Between the rivers Néstos and Strimón nine mountain districts have been delimited. They are high and rugged, and composed mainly of marble; the densities vary between 5 and 17, but the figures are greater where small basins are included, *e.g.* Nevrokópion (29).

The lines in Makedhonía and Thessalía have in general been drawn to distinguish mountains and plateaus from basin-plains, both these groups of features having trends from north-west to south-east. These highlands may be described in three parallel belts from east to west. In the broken and dissected plateaus west of the Strimón and ending in Khalkidhikí the variation, from 5 to 24, corresponds to the amount of smooth land, for the heights are not great: but the peninsula of Áyion Óros (13) is unusually populous in view of its rugged character: the twenty monasteries depending largely on external resources. The next belt, west of the gulf of Thessalonîki and the river Axiós, extends from the Nidže mountains on the frontier for some 250 km. to the peninsula of Magnísia. It shows great variety from densities of 5 or 6 in the north to 39 in the south, the summits of Ólimbos and Óssa being marked as uninhabited. Conditions of rock structure, relief, and water supply play a part in these differences while aspect also affects two areas which stand out on account of their intensive agriculture: the strip south of Mount Óssa (86) and the riviera east of Vólos (164). The most

westerly of the three parallel belts, some 150 km. in length, extends from the frontier near Flórina to the plain of Thessalía east of Tríkkala. The general density of population is very even, between 17 and 19, but it rises to 28 in the north for reasons that are not obvious, but may be related to higher rainfall.

The "population areas" of Ípiros are arranged in roughly parallel strips from the Albanian frontier to the gulf of Árta and are bounded generally by mountain crests. The densities are probably proportional to the amount of smooth land, and where the value exceeds 40 it may be taken that the plains included are considerable. Similar conditions affect the population distribution in Akarnanía south of the gulf of Árta; but here altitudes are much lower and it is the aridity of the karstic plateaus that hampers growth of population.

By far the greater part of Pelopónnisos can be classed as mountainous, since the limestone plateaus that are overlooked by the highest summits and form the largest element are either so deeply dissected by valleys or are so pitted by karstic depressions as to give a generally rugged surface, and cultivable soil is sparse throughout. Despite much diversity of relief the most striking fact revealed about the distribution of population is the uniformity of its density except where special conditions, to be mentioned, are effective. Thus, east of a line extending from Cape Pápas at the entrance to the gulf of Pátrai, south-eastward to Cape Taínaron forty-one out of the fifty-one districts outlined are mountainous, and of these thirteen have densities between 20 and 30. Those which have lower values are specially deficient in cultivable land. The higher densities are variously explained: those which occur on the abrupt and rugged northern slope (35 to 39) belong to areas which partake in some measure in the fruit cultivation characteristic of the narrow coastal strip. Adjoining these is a large highland tract with density 44 between the summits of Erímanthos and Khelmós, mostly in Akhaïa; abundant water-supply and many patches of weak impermeable rock probably explain the high value here. The Máni peninsula in the south on the other hand is populous (61 and 51) not because of its resources but from the remarkable attachment of an ancient people, the Maniotes, to their rugged homeland. Again the district showing the value of 41 between Mount Párnon and the gulf of Argolís includes several cultivable valleys deeply cut in a bleak limestone plateau.

The greater rainfall and somewhat more equable climate of the western slope of Pelopónnisos have reacted upon the density of population chiefly through the currant-growing, an intensive form of cultivation; and this applies to the lower mountain slopes as well as to the plains. Thus the figure 55 seen north of the river Alfiós is doubtless explained in this way and similarly, the still greater density south of this river; but the incompleteness of the map here leaves some doubt about the value 77. Southward of this fruit cultivation still keeps the population relatively dense and remarkably uniform, between 45 and 51, despite considerable relief. The peninsular part of Messinía while containing high hills is generally lower, and much of it is a smooth plateau of which the eastern fringe is a marine abrasion platform cut by very deep ravines. This highly cultivated shelf carries many large villages giving a density of 182 quite exceptional in Greece apart from true plains.

The plains

The plains differ widely in situation, area, and altitude; they consist of two principal types of land which vary in their proportions: firstly, the flat alluvial stretches of fine silt usually containing swampy ground in the lowest part, at least during the winter, and secondly, the higher land surrounding this composed of older detrital strata, generally of coarser material, forming lake terraces and river fans. These terraced margins are torn by ravines in varying degrees. Above all the plains differ in the amount of water available for agriculture, of the greatest importance in determining the intensity of cultivation and hence, the density of the population. But where water lies stagnant malaria prevails and the plain does not support the population that its area would indicate.

In 1928 the greater plains of Makedhonía had seen a recent and very large influx of refugees from Anatolia and neighbouring lands, and it was chiefly to provide for these immigrants that the Hellenic government undertook the important works of land reclamation by drainage and irrigation; not only in Makedhonía, but in Thessalía and Ípiros as well. Most of these tasks however were still in progress at the date of the census, and it seems likely that in such areas the population would soon have increased considerably but for the war.

The Greek plains form obvious units or cells of population and before considering their comparative capacity as indicated by the density values it is worth noticing how the groups vary in size. The population of the five largest units as delimited on this map are (in thousands): Upper Thessalía, 161 (63) [1]; lower Strimón, 145 (83); Dráma, 109 (134); Attikí, 95 (96), or including the Lávrion mining district, 104. But the three plains in contact at Thessaloníki contain by far the largest aggregation of people, 240, or nearly as many as the city itself: the western plain alone (67) has 96. The other large groups are those of the north-western coastal plain of Pelopónnisos, again taken as a whole (districts 97, north, to 100, south) with 125; of the upper Aliákmon basin (38), with 83; of Voiotía (58), with 68; of lower Thessalía (47), with 67; and of Messinía (225), with 45.

Agriculture is by far the most important occupation of the inhabitants of the plains; therefore the variations in density will be closely dependent on its character. In the following account the forms of cultivation mentioned are generally those which require relatively great labour and attention, mostly commercial crops; cereals however are grown in all districts and they occupy much the greatest area.

To refer first to the plains with very great densities, the small plain of Messinía which has an abundant water-supply, owes its high figure (225) to the intense cultivation of various tree-fruits for export, along with vines for currants and wine. It is the only agricultural district of the mainland exceeding 200 per sq. km., for the environs of Athens, estimated at over 1000, are of course suburban, and the surrounding plain of Attikí would not be assessed as high as 96 with agriculture alone as the occupation. The hilly mining district of Lávrion which adjoins this plain is shown separately (166). The plain of Árgos, somewhat larger than that of Messinía and with varied

[1] Density value in brackets given to allow identification on the map.

agriculture but less fruit, is less populous: the figure 154 would be 125 if the port of Návplion were deducted. Next to these in order come the currant-bearing plains of Pelopónnisos together with the most valuable tobacco-growing land of Makedhonía. In the former seven areas of coastal plain are delimited between the gulf of Kiparissía (100) and the isthmus of Kórinthos: all but one (50) where the land is poorer have densities above 90. Along with currants tree-fruits are prominent among the products throughout, olives and citrus fruits in the south and pears in the north; in Korinthía the sultana grape is replacing the currant. Among the large plains of the north that of Dráma has the highest density (134). Here a large proportion of the surface is devoted to the finest tobacco, and the leaf yields nearly three-quarters of the value of agricultural produce. The drainage of the marshes of Fílippoi, after 1928, gave promise of further production from other crops and presumably of increased population. The adjoining small plain of Mousthéni (107) at the foot of Mount Pangaíon is similarly noted for its tobacco. This product as well as cotton serves in part to occupy the people of the lower Strimón plain (83), but here cereals have dominated farming to a greater degree than they will in the future as a consequence of the recent regulation of the water-system: and increase of population had seemed likely. Tobacco again is more prominent and attains its highest quality along the hill-foot facing the coastal plain on both sides of the river Néstos (91). All these northern plains received a large influx of refugee settlers after the immigration, but east of the Néstos, *i.e.* in Thráki where Turks were left on their land the increase was small. Hence the density on the plain of Komotiní is low and is still probably characteristic of the condition prevailing on other northern plains before 1912, and this despite much attention to tobacco and silk production.

The flood plain of the river Évros and the adjacent slopes, where the production of raw silk has long been a leading business, shows a fairly uniform density (49) except where the implanting of a number of new villages raises the figure to 78.

There are several other plains that are notably populous because of agricultural specialization, upon tree-fruits and vines, but with silk, tobacco, or cotton in some areas, and of course with the necessary preparation and marketing of the produce. In the north-east these include the furrow between the Strimón and lake Doïran (86) with steep alluvial fans watered by torrents from the Belasitsa mountains, and the enclosed basin of Enotía (81), similarly related to the Nidže mountains. The district around Édhessa (76) south of this resembles these in products though in form only partly a plain, and so does the small basin of Sérvia (79) farther south and on the middle course of the Aliákmon. In the north-west the peninsula of Préveza (60), largely plain, has vast olive groves and vineyards, while the adjoining plain of Árta (101), the conjoint delta of the rivers Árakhthos and Loúros, specializes in oranges. In Akarnanía the low plain of Agrínion flanking the lakes (63 and 74) produces tobacco along with varied fruits. Amid the limestone mountains north of the gulf of Kórinthos is the winding canyon of Ámfissa and on its flat floor continuous olive groves which account for the density of population (125) in this oasis. Other small plains of central Greece which are

specially devoted to fruits are those of Mégara (75), three districts facing the gulf of Évvoia (76, 61, 74), and in the island of Évvoia the plain of Khalkís (136) where currants are grown and those of Kími (165) and Oreoí (93), and again on the mainland on the gulf of Vólos, the plain of Almirós (61).

The two large plains in Fthiótis and Fokís have some two-thirds of their land under cereals but also yield much cotton and fruit, especially table olives. The respective densities of 63 in the vale of the Kifissós and 88 in that of the Sperkhiós probably reflect the greater amount of irrigated land in the latter. The plain of Voiotía (58) includes the drained lake-bed of Kopaïs in which cotton is grown and also Levádhia a partly manufacturing town with a fifth of the population; most of it is typical grain land with a rural density lower than those of the plains so far mentioned.

It remains to refer to a number of large plains where subsistence agriculture prevails or where the chief commercial produce comes from cereal crops. The two examples of these in Pelopónnisos are the polje of Trípolis (60) and the basin plain of Megalópolis (46), both in the interior. The former without the town's population would have a density of 40, and a still smaller figure but for the exclusion here of the northern part of the plain (29) less populous from the prevalence of flooded land. The land in the Megalópolis basin, on the other hand, suffers from dryness since the rivers are incised. The two great plains of Thessalía had not yet benefited in 1928 from the works of drainage and irrigation; but these would not be expected alone to alter largely the divergence in density. The upper plain, that of Tríkkala (63) has always been the more populous; it is the better watered and has greater agricultural variety, while its inhabitants include those whose main interests lie in the summer pastures of the mountains. The density on the lower plain, that of Lárisa (47) is perhaps unduly exaggerated by the inclusion of this town: without it the figure would be 30. The fact that no large subdivision of estates like those of Turkish times had taken place was perhaps the chief explanation of this.

In western Makedhonía the two parallel belts of relatively low and flat country extending from north-west to south-east call for some description. That on the west, drained by the upper Aliákmon, is shown in two parts (38 and 13). The former contains much less flat land than the latter: it is a dissected plateau; yet even without the town of Kastoría the density would be 33. Certainly many of the inhabitants are also shepherds in the Píndhos, for whom there is probably no counterpart in the lower section. But even so, the main reason for the sparseness here represented by 13, remains to be discovered. The eastern zone comprises the plain of Flórina (76), the southern part of the upper Crna basin; that of Ptolemaïs (55), a basin of interior drainage; and that of Kozáni (52), drained by the Aliákmon. All consist of rolling or flat country devoted mainly to cereals and fodder crops, locally to tobacco, vines, and fruits. The high density of the northern section is probably due to the more abundant supply of water. Comparable with these basins is the plain of Ioánnina (84) and its lower northern extension (45). These, the only large plains of Ípiros, are concerned mainly with cereals and fodder; the density of the former would drop to 44 without the population of the regional capital.

The six plains bordering the gulf of Thérmai fall into two groups. Three of them include a good deal of land either steep or rocky or swampy, and despite some agricultural specialization have low densities: the steep fans east of Mount Ólimbos (40); the north-western part of Khalkidhikí including the bare ridge behind Thessaloníki (38); and the northern part of the Kambania with both rocky and swampy areas (34). On the other hand Píeria, a dissected basin with a small coastal plain and some fame in tobacco-production, shows an average of 56; the oval western Kambanía, in 1928 still surrounding the shallow lake of Yiannitsá, mainly under cereals but with much fruit and tobacco, has a density of 67, while the central Kambanía (108) owes its high value to the concentration of new refugee villages partly concerned with the affairs of the neighbouring city.

The islands

The population densities of the larger islands may be said generally to correspond to their respective agricultural capacities. But other considerations affect some of the smaller islands. Three of these in the Saronic gulf call for notice: Póros (307) is a summer resort; Aíyina (108) has a garrison as well as potters and sponge-fishers among its inhabitants; while Salamís (162) contains a naval dockyard. Farther south are Ídhra (74) and Spétsai (173), the former inhabited mainly by sailors, sponge-fishers, and merchants, and with some manufactures, the latter a community largely of sponge-fishers. Among the Kikládhes the outstanding case is that of Síros (322) still the chief collecting centre for the islands and occupied with shipping and commerce. Maritime interests are combined with agriculture in Skíathos (71) and Skópelos (64) in the Northern Sporádhes. Elsewhere it is chiefly agricultural wealth that accounts for large populations. Kérkira (172) stands out as the most completely cultivated and as producing vast quantities of olive oil, while the small and nearly waterless Paxoí (145) is notable for oil of fine quality. The other Ionian islands (91, 80, 101) are of course famous as producers of currants and many other fruits.

Each of the large islands of the eastern Aegean has a specialty among the products of intensive agriculture: thus Lésvos (85) with olive oil and tobacco; Khíos (84), with citrus fruits, olive oil, and mastic for liqueur and sweets; and Sámos (119), with olive oil, wine, and tobacco. Several of the Kikládhes have mineral resources added to the produce of the soil, *e.g.* Thíra (Santorin 132)—volcanic ash along with wine; Náxos (48) emery along with wine.

As already stated the distribution of population in Kríti has had to be mapped in a different and much less reliable way. The mean density is 47. The island is divided transversely into four Departments of which the mean densities from west to east, are: Khaniá, 47; Rethímni, 48; Iráklion, 54; and Lasíthi, 36. But the relief is great and since its trend is longitudinal the real units of population are areas lying mainly in this direction, and the lines shown on the map are drawn so as to bring this out. But the boundaries of the communes were not available and the position of some could not be identified. However with the help of the figures for those which could be found and the total numbers for the Departments, an attempt has been made to evaluate the densities approximately. But the most that can be

said of the result is that the possible errors will not be greater than 10 per sq. km.

I wish to express my indebtedness to the Carnegie Trust for the Universities of Scotland for financial aid in the reproduction of the map.

The names in this paper are spelled on the recently revised system of the P.C.G.N.

THE FOUR VOYAGES OF COLUMBUS

ADMIRAL OF THE OCEAN SEA, a life of Christopher Columbus. By S. E. MORISON. *Boston: Little, Brown*, 1942. 2 vols. xlv+448 and vi+446 *pages;* $9^1/_2 \times 6^1/_2$ *inches; illustrations and diagrams.* 10$

CHRISTOPHER COLUMBUS: Admiral of the Ocean Sea. By S. E. MORISON. *London: Humphrey Milford* (*printed in U.S.A.*), 1942. $9^1/_2 \times 6^1/_2$ *inches;* xx+680 *pages; illustrations and maps.* 21*s*

OF the many biographies of Columbus, none until now has been the work of an historian possessing more than a nodding acquaintance with the sea. This, of course, does not mean that they have necessarily been bad biographies, or that they deserve to be dubbed, to use Morison's derisive phrase, "Columbus to the Water's Edge." Even so, it is probably true to say that most writers have been more concerned to decide who Columbus was and what he thought than to discover precisely where he went and how he got there. Professor Morison, whose historical scholarship is apparently matched only by his practical seamanship, determined to redress the balance by going to sea in search of "light and truth," for, says he, "you cannot write a story of . . . fifteenth and sixteenth century narratives that means anything to a modern reader merely by studying them in a library with the aid of maps." A winter's sail in a chartered yawl along the line of the Windward and Leeward Isles and odd trips in patrol boats and native sloops along the shores of Hispaniola and Puerto Rico provided him with a living commentary on the contemporary narratives of Columbus' First and Second Voyages, and proved that field methods could profitably be applied at sea.

In 1939, under the auspices of the Harvard Columbus Expedition, Morison was able to purchase the barquentine *Capitana*, "near enough to Columbus's larger ships in rig and burthen to enable us to cross the ocean under conditions very similar to those of his day, and to view islands and coasts as through his eyes." Captain William D. Stevens contributed his 45-foot ketch *Mary Otis* as the *Niña* of the expedition. Arrived at Palos in early autumn, the two ships proceeded by way of San Lucar and Cadiz to Porto Santo, Madeira, and the Canary Isles. Their ocean crossing from Gomera to Trinidad and Margarita was approximately on the route of the Third Voyage. From Margarita they sailed to Cartagena and the Gulf of Darien where they joined the route of Columbus' Fourth Voyage. Later, during the summer of 1940, Stevens and Morison took the *Mary Otis* along the course of the First Voyage from the El Salvador landfall through the Bahamas to Cuba and along the Oriente Province to Cape Maisi where they picked up the route of his Second Voyage of 1494.

Armed with this newly-won knowledge and all the usual documentary material for the Columbian epic, Morison has written a book of great interest

and no small originality. Not that he tells us very much that was not already known or surmised, for few of his conclusions will startle the informed reader: the originality lies in the telling of the story, rather than in the findings. Throughout he narrates the life of Columbus for what it really is: one of the greatest stories of adventure, daring, and faith in the annals of history; and he tells it in language which, to say the least, only an American could employ. At the same time Morison does not neglect the problems connected with Columbus' birth, nationality, early life, and objectives and, notwithstanding his reiterated unconcern for Columbian "mysteries," a good deal of space is devoted to analysing the character of Columbus, his "motivation", and his "destiny." The following extract is typical of Morison's stimulating approach to such matters:

"Christopher Columbus belonged to an age that was past, yet he became the sign and symbol of this new age of hope, glory and accomplishment. His medieval faith impelled him to a modern solution: expansion. If the Turk could not be pried loose from the Holy Sepulchre by ordinary means, let Europe seek new means overseas; and he, Christopher the Christ-bearer, would be the humble yet proud instrument of Europe's regeneration. So it turned out, although not as he anticipated. The First Voyage to America that he accomplished with a maximum of faith and a minimum of technique, a bare sufficiency of equipment and a superabundance of stout-heartedness, gave Europe new confidence in herself, more than doubled the area of Christianity, enlarged indefinitely the scope for human thought and speculation, and 'led the way to those fields of freedom which, planted with great seed, have now sprung up to the fructification of the world.' In his faith, his deductive methods of reasoning, his unquestioning acceptance of the current ethics, Columbus was a man of the Middle Ages, and in the best sense. In his readiness to translate thought into action, in lively curiosity and accurate observation of natural phenomena, in his joyous sense of adventure and desire to win wealth and recognition, he was a modern man. This dualism makes the character and career of Columbus a puzzle to the dull-witted, a delight to the discerning. It unlocks most of the so-called Columbus 'mysteries,' 'questions' and 'problems,' which were neither mysteries, questions nor problems to his contemporaries, but recent creations of dull pedants without faith who never tasted the joy of sea adventure."

But Morison is nothing if not provocative; while hyperbole may impress the "dull-witted," it is unlikely to satisfy the "discerning" reader—especially when, as is occasionally the case, it is employed to cover up the deficiencies of an argument. To take only one instance: the problem of identifying Columbus' original objective. The author finds that Columbus' annotations of D'Ailly's 'Imago Mundi' and Aeneas Sylvius' 'Historia Rerum Ubique Gestarum' (which together with 'The Book of Ser Marco Polo' and Pliny's 'Natural History' constituted his chief reference works), "point to one object and one only of the Great Enterprise: to reach the Orient by sailing west. . . . The postils afford very cold comfort to those trying to prove that Columbus was seeking nothing more important than new Atlantic islands, that his interest in the Orient arose only when he missed Antillia." To those of us who, like Vignaud, point out that the Capitulations, the Titulo, the letters of credence to foreign potentates, the passport and the royal orders concerning the fitting out of the fleet, make no mention whatever of the Indies and from this omission infer that Columbus' original plan may only have been to discover some unknown islands such as Antillia, Morison retorts that "The phrases 'islands and mainlands of the Ocean Sea' meant Japan, China and neighboring islands." This, he says is "sufficiently proved by the fact that when Columbus returned in

1493, insisting that he had discovered Cipangu and certain outlying dominions of the Grand Khan, nobody contested his right to be Admiral, Governor and Viceroy thereof, and the Pope freely conceded Spanish sovereignty over them. Moreover, the agreement of April 17 mentions 'pearls, precious stones, gold, silver and spices' among the products that the Admiral will be privileged to tithe, and these were of the Orient. . . ." This, we submit, proves very little. In 1493 the people of Spain—doubtless the Pope himself—were far more interested in learning about the new lands than about Columbus' legal claims concerning them, while as for the Oriental monopoly of gold, precious stones, and the like, had not the Portuguese been trafficking in the self-same commodities for the past fifty years in west Africa? Furthermore, if Morison's interpretation is right, we must suppose that Ferdinand and Isabella were childish enough to believe that three small vessels with ninety men could sail into a harbour of Japan or China and simply take over. This suggestion Morison willingly accepts, for, he affirms, "Europe envisaged the kings of the Orient as no better prepared to defend their possessions than the sable potentates of the Dark Continent." Here, it seems to us, Morison is palpably in error: simple the khans may have been, but no one who had heard of the Tartars or read Marco Polo could possibly accuse them of being servile and passive resisters.

With regard to his treatment of such problems as the authenticity of the Toscanelli correspondence and the Journal of the First Voyage, there will be more general agreement. Concerning the former, much water has flowed under the arches since the time of Henri Vignaud: the most recent critical examinations of the subject (notably that by Dr. Diego Luis Molinari in 'Historia de la Nacion Argentina,' II, 1937) have gone a long way towards destroying the thesis developed at such length in his famous 'Histoire Critique.' On the second question, and here we have demonstrated the kind of benefit accruing from research in the field, Morison makes the following pronouncement: "The charge that he [Las Casas] or anyone else garbled the Journal is false. My shipmates and I, who have probably given the Journal the most intensive study to which it has ever been subjected, will go even further. We say that nobody not a seaman, and no seaman who did not follow Columbus' route, could possibly have faked this document, so accurate are the bearings, the courses and the observations; and any such navigator would have needed the aid of the cleverest of literary forgers to complete the work, so closely are woven into it Columbus' ardent quest for the Indies, and the wonder and surprise at completely new experiences. Columbus did not even take the trouble to expunge the numerous mistakes that he made in navigation and which he knew to be mistakes a few days later."

There can be equally little quarrel with Morison's reconstruction of Columbus' routes and landfalls for, in the realm of sea-going historians, Morison has no competitors. In broad outline, his routes agree with previous interpretations, but his sailing experience has made it possible to follow Columbus' explorations along the American coasts and among the islands of the Caribbean, to mark his anchorages, and to identify the points that he named with a degree of accuracy hitherto impossible. The production of a set of charts drawn on a fairly large scale and covering the whole of Columbus' seafaring activity in the New World is in itself no mean contribution to our knowledge. Among the new interpretations, the following are noteworthy: for the *First Voyage*: Columbus' course in the vicinity of San Salvador, his landfall on Cuba, and the identification of the site of La Navidad. For the *Second Voyage* the track given by Morison diverges most from hitherto suggested

courses. He argues that Columbus must have sailed along the lee shores of the Lesser Antilles, *e.g.* along the west coast of Montserrat and along the south coast of Puerto Rico, and has also reconstructed in detail the course in the Virgin Isles and along the southern coast of Cuba. For the *Third* and *Fourth Voyages* Morison's routes do not appear to be very different from those suggested by others, but again he gives more detailed charts (*e.g.* for the course in the Gulf of Paria and along the coasts of Honduras and Panama), and, *inter alia*, identifies the place where Columbus first made contact with the American continent, and where the *Capitana* and the *Santiago* were finally beached on the coast of Jamaica.

In a work of such magnitude, containing as it does information culled from a score of sciences and nearly as many languages, mis-statements were almost bound to creep in. At the risk of appearing uncharitable, and there is every reason to be grateful to the author and his shipmates for their fine achievement, the reviewer takes leave to point out a few errors. Sea-charts, by which Morison clearly means portolan charts, were not always embellished with "hypothetical islands, such as Antillia, Cipangu and Cathay"; mostly they dealt only with *terra cognita* (*e.g.* the Benincasa charts). There is nothing surprising about the N.E. Trades blowing in the region of 9° 30′ N., 29° W. in late July (see p. 526, single volume edition); clearly Morison does not appreciate the fact that there is no fixed equatorial limit to the Trades, but that they swing first north, then south of their mean position for any given month. What is surprising is, firstly, that Columbus on his Third Voyage was becalmed in roughly the above position for eight days, since there is not more than a 3–4 per cent. chance of calm conditions obtaining there at that time of the year; and secondly, that he did not run into south-westerly winds which in late July and August often prevail in that area. The chart of the Third Voyage (pp. 522–523) has some meaningless legends: there is no clue to show how the "length of arrows show the duration of winds," while the numbers do not show its force, and the figures in the centre of the wind roses certainly do not give the number of days of calm.

For all his nautical experience, Morison does not seem to be particularly weather-minded: he talks of "strong sea-breezes at eight o'clock in the morning off Palos," of the Azores being notably cold and rainy in winter and being one of the stormiest regions of the North Atlantic, of the impossibility of avoiding a hurricane with a June crossing of the central Atlantic (it is a bad season that yields more than three or four "twisters" and they are much more likely to be encountered in August or September than in June or July), of cyclones when he means depressions, and of the "strange phenomenon" of a westerly swell in the rear of an east-moving disturbance (actually it would be strange were the swell to run from any other direction behind such a system).

Apart from shortcomings such as these, the reviewer has only one complaint, and this concerns the manner rather than the matter of the work. American slang has its uses, but "swabs," "mugs," "good guys," "phony reckonings," "screwy latitude sights," and such-like, are hardly appropriate in so important a work.[1]

G. H. T. KIMBLE.

As regards the many thorny problems of navigation connected with the

[1] The single volume edition is a condensation of the two-volume edition and was published at the same time. All the notes and bibliographical references have been omitted, along with a good many pages of navigational data: a chapter on ships and sailing and one on the origin of syphilis have been summarized. Otherwise the two editions are practically identical.

recorded history of Columbus' voyages—particularly the plotting of his tracks among the West Indian islands, and the identification of his various anchorages —Professor Morison's book represents a great advance, in method, beyond anything previously accomplished. For the first time, Columbus' routes have been followed, as closely as possible, in modern vessels of approximately the same size as his own; sailing, under similar conditions, in the same waters; and provided, for reference and comparison, with all the extant information on record as to his doings. In the Preface Professor Morison states that he followed Parkman in using this method: as Parkman, incidentally, followed Macaulay, the first modern historian to employ it. At sea, the only earlier user appears to be Mr. G. C. Henderson, in his work on the discovery of the Fiji Islands.

Four chapters (IX, X, XII, and XIII single volume ed.) give a very valuable account of the ships, the crews, the customs, and usages of the sea then obtaining, and the navigational methods and instruments employed. These chapters show much research and are, in general, extremely accurate, but it may be noted that Pero Nuñes was not the inventor of the vernier (p. 186), his clumsy Nonius of 1542 bearing no real resemblance, either in principle or detail, to Pierre Vernier's invention of 1631. And one would like a little positive evidence that Columbus (p. 184) never possessed, and probably never saw, a cross-staff (fully described, and referred to as long-known, by Werner in his treatise of 1514).

While admitting, and indeed proving (*e.g.* pp. 258, 268, 284, 524), that Columbus was a very poor hand at astronomical observations, Professor Morison gives him unstinted praise for his ability to navigate by dead reckoning; not only in coastal waters but also (and here indeed the praise seems slightly excessive) on the high seas. In this connection it must be pointed out that in discussing Columbus' ocean-tracks both Professor Morison and the Expedition's navigator, Lieut. McElroy, U.S.N.R., attach little or no weight to a most important source of error. They regard the course logged, when corrected for variation and current (if any), as identical with the course made good; a rare occurrence which no navigator of even a modern steamer would expect. Columbus' ships were tiller-steered; and the helmsman, unable to view either the sails or the sea-horizon, was entirely dependent on a small, crude compass. In such circumstances, accurate steering could not be expected. But, above this, the paramount factor of leeway is ignored. Lieut. McElroy indeed writes of the outward First Voyage,[1] ". . . the Journal indicates that strong breezes from a quarter which might have created noticeable leeway were conspicuously absent. . . . Thus leeway . . . may be practically disregarded." But, actually, a vessel under sail makes a certain amount of leeway with the wind in any quarter except right astern; and this would have been at all times noticeable in the navigation of Columbus' bluff-bowed, broad-beamed little ships. It is singular to find Professor Morison (p. 401) assuming, as the only possible explanation why in his second outward voyage Columbus consistently steered W. by S. all the way across, and yet made good W. by S.½S., that he "must have been using Flemish compasses, which were adjusted for one-half point of easterly variation." The true explanation is much simpler. During the voyage the wind (p. 402) blew steadily and fresh from N.N.E., and that in such circumstances ships running W. by S. should make half a point of leeway was more a matter for congratulation than surprise. To neglect leeway in assessing the merits of Columbus' navigation is bound to give fallacious results; and the fact that in the outward half of the first voyage (and on that occasion only) his

[1] Lieut. John W. McElroy, U.S.N.R., "The Ocean Navigation of Columbus on his First Voyage," *The American Neptune*, vol. 1, no. 3, 1941.

D.R. at the time of the landfall, corrected for overrun but not for leeway, agrees fairly closely with his ascertained position should be ascribed chiefly to an accidental compensation of errors, rather than to his skill in ocean-navigation.

As to the identification of that much-disputed first landfall, Professor Morison (p. 228) assumes, without discussion, that this must have been Watling island. Such, it is true, has been the general view since 1884, when Lieut. (afterwards Rear-Admiral) J. B. Murdock, U.S.N., published his classical discussion of the subject. But, as has since been indicated (*Geogr. J.* May 1927), there is a weak link towards the end of his chain of reasoning. What he actually established, working backwards along Columbus' track from Cuba, was that the second island visited was undoubtedly Rum Cay, and that in consequence the landfall must have been either Watling island or Conception Cay. And so the matter rests to-day. Both possess all the features enumerated by Las Casas: a large central lagoon; a portion of coast running N.N.E.; a readily fortifiable islet, or quasi-islet, sheltering an anchorage; and a fringing reef all round. There is no conclusive evidence as to size: Las Casas calls the landfall "a small island" on 11 October 1492, but two days afterwards speaks of it as "very large and level." And with regard to two crucial points, the mysterious light seen in the first watch many miles to windward of the landfall, and the fact that several islands were in sight simultaneously from the latter, it is worth noting that the selection of Conception Cay provides, for both, a reasonable solution, while the choice of Watling island affords none for either.

But, dismissing these questions of ocean navigation, one can follow Professor Morison through West Indian waters, as he followed Columbus, with wholehearted admiration. One after another, headlands, anchorages, reefs, and sites whose positions were either unknown or extremely doubtful, are painstakingly investigated and identified in a manner which carries with it complete conviction. Even if the work should one day be repeated, it is difficult to imagine that Professor Morison's identifications will ever, except on the most minor points, be upset or even seriously questioned. So far as the work of the Harvard Columbus Expedition has gone—Professor Morison indicates that it is unfinished, and may one day be resumed—it has conferred great and lasting benefits upon geographical research, and if its leader's obvious enthusiasm for the great Genoese should occasionally lead him into an excess of hero-worship (as when, on p. 468, he brackets Columbus, *as a navigator* with Cook); well, every man has the defects of his qualifications. And those of Professor Morison for the task he set himself are clearly very great.

R. T. GOULD.

REVIEWS

ASIA

THE GOBI DESERT. By MILDRED CABLE with FRANCESCA FRENCH. *London: Hodder and Stoughton*, 1942. 9×6 *inches;* 304 *pages; illustrations and map.* 21*s*

"Great journeys do not merely consist in passing over vast spaces but owe their greatness far more to the human intercourse and knowledge of fellow men which they involve." Thus do the authors of this remarkable book epitomize their philosophy of travel which is exemplified throughout its closely-printed three hundred pages. It does not often happen that a classical survey of a great region, and it certainly deserves to rank as a classic, results as a bye-product of a missionary journey. Miss Cable and the two Misses French, her companions, one of whom collaborated in the preparation of the book, make no secret of the real objects of their many years of planned wanderings in the recesses and borderlands of the Gobi. As missionaries of twenty years' experience in Shansi province, whose close traditional connections with Chinese Central Asia first drew their attention to it, they had thought out their plans long before and made arrangements for the supply of Christian literature in the current languages of Turkistan which they distributed all along the routes they followed and deposited round its water-holes for the enlightenment of future wayfarers. Yet in all their descriptions and analyses of desert life they achieve a wonderful objectivity and the central purpose of their journey is never unduly protruded nor allowed to affect the broad perspective of the picture which they present or rather, in Chinese fashion, unfold.

The authors make no pretence of elaborate scientific equipment or training. Their discussions however of such phenomena as the musical sands, progressive desiccation, and desert encroachment on ancient settlements, are marked by shrewd commonsense and illuminated by careful observation. The physical basis of life in this austere environment is most realistically portrayed and it would be hard to improve on the excellent chapter called " What the desert can supply" (pp. 94–105), which surveys its botanical resources in relation to man's needs. In the Gobi as an archaeological treasure-house, concealing in remote caves and shrines exquisite specimens of Islamic and Buddhist (including Graeco-Indian) art, they show deep interest and appreciation. For interpretation in these matters they rely mainly on Sir Aurel Stein, but they definitely add to the data on which future archaeologists can draw.

It is however in the field of the social and human geography of the Gobi that they make their greatest and very notable contribution. Here the qualities and training which enabled them to enter fully into the lives of an astonishing variety of people and to appreciate all the factors of present environment, religious faith, and historical background which shape their point of view and their attitude to one another, have full scope. Seldom can travellers in a country so abounding in mutually suspicious groups as the Gobi have made such a multitude of friends among nearly all of them. Before they finally returned to Shansi they were evidently welcomed as familiar and honoured guests in most of the oases and even in nomad camps. In consequence they can reveal the distinctive personality of many strongly contrasted centres: Hami, the thronged and prosperous emporium where the trade-routes diverge to north and south of the Tien shan; Mu-lei-ho or "Shansi over-sands," as they aptly christen it; Urumchi, the administrative capital and "city of dark intrigue"; Chuguchak,

the "Siberian" town which home-sick Russian emigrés have gradually developed just on the Chinese side of the frontier; Barköl and Pichan, both of them Ears of the Gobi but Barköl with its ear to China only, and cosmopolitan Pichan with its ear alert for news and rumours from across the Himalaya, from Western Asia and Europe *via* Kashgar, and not least from Soviet Russia.

Perhaps the most valuable chapter in the whole book is that on "The intercourse of the Gobi," a most intimate and penetrating study of the bearing and characteristics, the domestic setting and home life, and the inter-relationships of the Chinese, Tungans (Chinese Moslems), Turki, Mongols, and Russian emigrés, the major elements in the composite society of a world which, with all its isolation, is at once a place of refuge, a land of transit, and a centre of trade. "On the basis of common humanity and as Christian missionaries," write the authors, "we found a place in each of these varied homes. . . . Thus we learned to live among women of many nationalities and to develop, in our nomadic life, the art of being 'at home' in a crowded *serai*, or a Mongol *yurt*, a Siberian *isba*, a Chinese courtyard, a mud-shack, a camel-driver's tent, or the palace of a Khan." To the full-length portraits of these major types are added slighter but valuable sketches of more occasional visitors to the *bazars*: Manchus from Ili province, retaining the speech and characteristics which have now almost vanished from Manchuria itself, wealthy Noghais from the Siberian border and Uzbek family parties from Russian Turkistan.

The value of this comprehensive and comprehending study of the human drama of the Gobi is enhanced by the fact that, as the authors themselves increasingly realized, they were seeing it at the end of an era, an era which began at least as far back as the first establishment of Chinese hegemony in Central Asia under the Han Dynasty. In the intervening two thousand years the human life of this vast oasis-studded wilderness has run a traditional course, so that in all essentials the scenes which our travellers describe must be similar to those witnessed by Marco Polo in the thirteenth and by Hsüan Tsang, the famous Buddhist pilgrim, in the seventh century. But within the last few years new factors of tremendous import have begun to operate and the Gobi, as the authors graphically describe in the Epilogue, is being rapidly drawn into the vortex of modern life. Rapid lorry traffic on motor roads, leading to the desertion of the smaller oases and concentration of travellers' quarters in the larger centres, and loud-speakers, which, as vehicles for Soviet propaganda, are replacing the old medium of news through itinerant merchants, are outward manifestations of significant change in the contacts of the Gobi. Miss Cable and her companions were guests in his summer palace at Aratäm when the death occurred of the last Moslem Khan who, as King of the Gobi, with his principal residence at Hami, partially reconciled the turbulent Islamic majority of Turkistan to the external control of China. The attempt to use the opportunity of his death to make that control more direct and effective was quickly followed by the Moslem Revolt of 1930, which is described in some detail in this book. Moslem revolts have been periodic in Turkistan for several centuries, but this led to novel developments. The brilliant and ruthless Ma Chung-ying seemed likely at one stage to establish a new Moslem power in Central Asia, but the intervention of Soviet Russia and the conclusion of a commercial treaty between the U.S.S.R. and the Chinese Government of Sinkiang prevented it. Soviet Russia collaborated in the suppression of the Revolt but obtained under the treaty valuable commercial privileges. The Soviet power now draws the greater part of the trade of Chinese Turkistan to its marginal railways (Turk-Sib. and Trans-Siberian), the main commercial artery of the Gobi is known as the Red Highway, and its most promising young

scholars cross the border for their higher education. Yet no part of the old Chinese Empire is more vital to the China which will emerge from the World War than this which holds her historic routes to the West. Of the many problems of political geography which will await solution few are of greater significance that those of the territorial relations of the New China and the U.S.S.R. and the control of this crucial part of what Sir Halford Mackinder has called "The geographical pivot of history."

A defect of this fascinating book, which should be remedied in a second edition, is the absence of an index. It is also rather deficient in maps, but there are several excellent photographs and three exquisite plates in colour. P. M. R.

AFRICA

ACROSS MADAGASCAR. By OLIVE MURRAY CHAPMAN. *London: Ed. J. Burrow*, 1943. $7\frac{1}{2} \times 5$ *inches; 144 pages; illustrations and map.* 9*s* 6*d*

One of the interests of this book is that it comes at a time when this large and important French Colony has so recently been in the war news. That Madagascar is so little known to people in this country was probably due to the fact that ordinary means of access are not easy for the tourist; and travelling facilities inland from the few ports are almost absent. Moreover Tamatave, the chief port, is rather off the trade routes and was served only by the Messageries Maritimes line direct from Marseilles *via* the Suez Canal, or from Durban and the Cape, *via* Mauritius and Reunion, by the K.P.M. Dutch line. There were no direct sailings from Beira.

The books on this, the fourth largest island in the world, are few. The original work of Alfred Grandidier of Paris is the greatest. Among others, those of J. Sibree, of the London Missionary Society, Dr. C. Keller, and, rather more recently, 'The drama of Madagascar,' by Sonia Howe, the authority on French Colonial history, are valuable. For the anthropologist Linton's book on the Tanala Tribe is one of the few scientific accounts of the habits and customs of the Malagasy native.

Mrs. Murray Chapman's book will be welcomed by many. The author gives an interesting and racy account of the parts of the country she visited, covering as she did a large area for the time at her disposal. This is all the more remarkable as much of the travelling must be done by *Filanzana* (carrying chair), if the country and its people are to be visited in their own villages.

The author's main object was to visit the Tanala tribe in the Antaimoro district on the east coast, and her description of these primitive people in such a remote part of the country makes very interesting reading and adds considerably to the knowledge of native life at the present day. That she was able to obtain a photograph of one of the Tanala burial places is a matter for congratulation and satisfaction as there is no record of this having been done before.

The very primitive and superstitious nature of the forest dwellers in comparison with the more aristocratic and intelligent Hovas is well brought out in Mrs. Murray Chapman's book.

There is no claim to have added anything of special geographical interest, and there is little of anthropological value that could be recorded without spending longer in the country and without a knowledge of the language. The special interest of the book is that the author was single-handed, often with an indifferent interpreter, and such journeys in the forest areas are made with all the minor discomforts of narrow, steep mountain tracks, heavy rain-storms, as well as leeches, rats, and the ubiquitous mosquito. That there are no wild animals larger than the Lemur will come as a surprise to some readers.

Apart from one or two misprints the book is well produced for war-time, especially the photographs facing pp. 33 and 81. Some of the altitudes are overstated, *e.g.* the motor road from Antsirabe to Fianarantsoa does not rise above 3500 feet, certainly not to 8000 as mentioned on p. 46. Also the precipitous cliff from which the Malagasy Christians were hurled to their death is at the east end of the city of Tananarive, not the west (p. 13). There is a good map in the cover at both ends and the index is adequate. C. R. P.

AUSTRALASIA

THE MAKING OF MODERN NEW GUINEA, with special reference to culture contact in the Mandated Territory. By STEPHEN WINSOR REED. Memoir of the American Philosophical Society, volume XVIII. *Philadelphia*, 1943. 9×6 *inches;* xix+326 *pages; illustrations and sketch-map*

This report was written at the instigation of the Institute of Pacific Relations. It is an inquiry into the effects upon the primitive natives of New Guinea of contact with white men over many generations, or, as we may say, the effects upon a Stone Age mentality of contact with a higher type of mentality. The research was carried out by the author in 1936 in the Mandated Territory of New Guinea, an intensive study being made for five months of the cultural and social life of one tribe, the Kwoma, a mountain people of the Upper Sepik river. The remaining three months were devoted to a general examination of the lives of sophisticated natives of missions, plantations, mines, government stations, and domestic service. These personal experiences are used as criteria for judging whether white man's influence has proved deleterious or otherwise, and in what particulars the Papuan life has been changed.

There is a wealth of material collected here from all sources, references to the extensive literature upon New Guinea, including official reports, newspapers, journals, and some information hitherto unpublished from conversations with individuals. The whole is arranged in a most painstaking manner, the narrative clear and fully documented, with a good bibliography and an index.

But with regard to the results of the inquiry it is not everybody who will agree with the author's findings.

The present population is placed in three categories: Papuan aboriginals; Europeans; and *Kanakas, i.e.* Papuan employees or the sophisticated type of native. The gradual introduction into New Guinea of other nationals is traced in periods, from the time of the adventitious appearance of early explorers to the spasmodic settlement of Europeans, followed by the period of the German Protectorate, with a survey of methods of their administration of the natives, and finally the change to the Commonwealth Government under mandate to the League of Nations, with its administrative policy based on the rights of Papuans as the true owners of the territory.

In an interesting summary at the end of the first chapter an attempt is made to define causes why the Papuan village community has not led to a further development of tribal organization. For this is indeed a common characteristic of the Papuan social units, that no superior castes such as those of chiefs and paramount chiefs exist, and apparently never have existed. The headmen of villages possess little power or responsibility, being mainly head of the club house, with prestige varying according to individual reputation or perhaps the inherited *mana* of a predecessor.

Therefore it is surprising to find the author in his introduction questioning whether the Europeans of the Territory are doing their utmost to hasten the time when Papuans can be given self-government. There is surely a long way to go

before such a step can even be visualized where not even the scaffolding exists to build upon. The primary education of Papuans in responsibility towards others is already inaugurated through the institution of a native constabulary with regular and also village constables. These have been merely referred to in the report, but actually they fulfil the need of chiefs and have more prestige and power than the headmen of villages. The success of the experiment cannot be doubted, some results are remarkable as examples of self-effacement and self-sacrifice which are non-existent in Papuan ideology. Examples of devotion to duty of individual constables are matters for discussion in every village, concrete rewards by the Government are visible to every eye in the award of stripes, which the Papuan constable wears so proudly and which carry enormous prestige, just as the deprivation of a stripe is a very severe humiliation. Here is surely the first step towards greater responsibility.

The experiment in the neighbouring Territory of Papua, where the whole Territory is practically pacified, of inaugurating village councils to take practical part in their own government did not meet with much response. It is frequently forgotten by outsiders that natives with a Stone Age mentality cannot be aligned with those of more advanced intelligence in other parts of the world. The reasoning faculty must first be evolved before it can be trained.

In the seventh chapter evidence is given that the Papuan population does not tend to decrease except locally and temporarily as a result of civilized influences; that native crafts have deteriorated in artistic value; and that inter-tribal trade has definitely increased. Customs of head-hunting, cannibalism, and black magic are discontinued in controlled areas. There are other modifications of cultural customs attributable to white man's influence which are brought about by the younger men returning from indentured labour. A new standard of living has arisen owing to acceptance of some European introduced foods.

What almost constitutes a new race is portrayed, dependent upon white man to a degree nearly comparable with that of his domestic animals. The author appears to visualize a future New Guinea peopled with these sophisticated Papuans, who have renounced or modified the old cultures and barely assimilated any part of our own. It is a dismal picture.

There are however points bearing upon this matter which do not appear to have come under consideration. For the Papuan rarely accepts white man's verdict on any matter that touches his innate cultural beliefs. He is not really converted to a new form of belief. He will accept without question anything concerning what he considers to be white man's province: machinery, tools, arms, medicine, government, etc. He will acquiesce in what he concludes white man wants him to think, but without inward conviction. Boss boys and mission boys with the greater part of their lives passed among white men will scoff openly at ghosts or sorcerers' spells, merely for expediency, but, if put to the test, will betray absolute conviction of the reality of supernatural agents and powers and the *tabus* of their forefathers.

Also need it be a foregone conclusion that in the course of time the old Papuan tribes will be ousted and their place taken by these semi-civilized natives? New Guinea is not a white man's country: there is nothing to encourage his colonizing the hinterland and mountains. Only the oil and minerals attract him and these are not inexhaustible. As yet the cultivated areas of New Guinea are mere scratches in the unbroken forest of that huge island. Is it not therefore fully early to bemoan the passing of the Papuan aboriginal?

There are slight errors in the report. The first paragraph on p. 82 reads as though British annexation followed the German, actually it was the reverse. On 16 November 1884 the German flag was raised at Friedrich Wilhelmshaven,

ten days after the raising of the British flag at Port Moresby. On p. 260 "the White Government speeds the break-up of the older order by appointing village officials who are not of the higher class." The paper from which this is quoted was written on the Solomon Islands where chieftainship does exist, and not on New Guinea where there is no "older order." On p. 29, "Native fermented drinks . . . are completely unknown in New Guinea"; also footnote 62, the only mention of Kava drinking in New Guinea is from the Admiralty Group. But alcoholic drinks are made by natives in Dutch Territory. Wollaston reports wine from the sugar palm, *Arenga saccharifera* in 'Pygmies and Papuans,' Chap. 8, 1912. Moreover Kava is drunk in parts of the Western Division, Papua ('Handbook of the Pacific Islands,' 1921). L. E. C.

ECONOMIC AND HISTORICAL GEOGRAPHY

EGYPT IN THE CLASSICAL GEOGRAPHERS. By the late Dr. JOHN BALL. *Cairo: Survey of Egypt*, 1942. $10\frac{1}{2} \times 7$ *inches;* vi+203 *pages; illustrations and diagrams*

When the late Dr. John Ball died in 1941 he had almost completed the masterly work on Egypt and the classical geographers which has now been published by the Survey of Egypt under the care of Dr. G. W. Murray, who had been his colleague for many years and had constantly discussed the book with him while it was being written. In a spirited foreword Dr. Murray explains that the textual critics have said practically their last word on texts and translations, and thereby cleared the way for the author, with his special knowledge of the topography of Egypt, to "approach his ancient precursors in geographical study without undue respect. Tradition and the reputations of his authors weighed with him not at all. Herodotus, Strabo, and Ptolemy, as well as the smaller fry, were to him fellow labourers in the same field and their works to be treated as those of his contemporaries, that is to say strictly on their merits."

In a series of unnumbered sections and with no division into chapters, John Ball has surveyed the geographical ideas of the ancient Egyptians, the work of the Greek geographers before Herodotus, and then at full length the writings on Egypt of Herodotus, of Scylax, Eratosthenes, Diodorus, and so throughout the classical geographers up to George of Cyprus, who wrote about A.D. 606; the whole excepting the last having been left complete by the author and needing only an occasional footnote by the editor. Each author is surveyed in detail and every place-name mentioned is discussed. Every position given by Ptolemy is examined, compared with the modern positions, and the differences discussed, and the same careful treatment is given to all the distances given by Scylax, the Antonine Itinerary, and similar works, with carefully conjectured corrections to distances obviously wrong, owing in large part to the errors of copyists not always familiar with the niceties of Greek alphabetical numerals. The body of the work thus tends to be tabular and of detailed rather than general interest. By far the larger number of names are identified with modern names of town, village, or site, but there is little indication of how far these identifications are new, or when they are to be read as correcting earlier identifications which the author considers erroneous; and one may say that the book would have been more interesting if something more had been done in this respect.

There is nothing like a map on any of the Egyptian sculptured monuments, and only a single fragmentary papyrus sketch-map of the 19th Dynasty, now in the Museum at Turin; but the well-known wall-paintings on two tombs at Thebes, reproduced in Plate I, show surveyors at work with twisted cords of 100 cubits. In the days of the Middle Kingdom the Egyptian surveyors were

able to calculate correctly the areas of triangles, but later their methods became erroneous, and in spite of all the science of Euclid and Eratosthenes and Ptolemy a wrong formula for the area of an isosceles triangle was employed continuously until about the year A.D. 1892, to the advantage of the revenue.

The Turin Papyrus fragments (Plate VII) of about 1100 B.C. show a gold-mining area referred to on Ball's first page as unidentified, but identified by Dr. Murray in Appendix I with the aid of a second series of fragments (Plate VIII) described by Professor Alan Gardiner in 1914. These show a place which is certainly the famous quarry of grey schist in the Wadi Hammamat, and the gold mine is that of Umm Fawakhir. Dr. Murray remarks that the dark rocks of the wadi are coloured grey on the papyrus, and the bright red granite hills around the mine are coloured pink. The earliest map known is therefore also a geological map. The locality is east and a little north of Luxor, half-way to the sea.

Herodotus spent only three and a half months in Egypt, about 450 B.C.; he contrived during that time to ascend the Nile to the first cataract, measure the Pyramids, write a curious description of the Fountain of the Sun at Siwa, most convincingly interpreted by Dr. Ball, and to obtain the material which fills the second of his nine books. He used various units of length, but happily gave a table of their relations, making the stade 600 feet. Ball, following the opinion expressed by Colonel W. M. Leake in a paper published in the old *Journal R.G.S.* in 1839, maintains firmly that there was only one stade known to the Greek geographers, the stade of 600 Greek feet. But when he asserts that it was equal to 185·3 metres, by a strange coincidence one-six-hundredth of the mean length of a degree of latitude or exactly the marine cable of 10 to the nautical mile, his argument is not so clear. He says that the Greek foot is known "from measurements of the Greek Hall, called by Plutarch the Hekatompedos, in the Parthenon at Athens, to have been nearly equal to 12·16 English inches, or 0·3088 metre." But 1216 inches or 30·88 metres is Penrose's measure of the length of the upper step of the east and west fronts, while the internal length of the Hekatompedos, the larger chamber, is a metre less, and the external length 2 metres more. Leake takes the upper step as 1213·75 inches, from Stuart; but no one gives the authority for believing that the step, and not the "hundred-foot" chamber itself, was intended to be 100 Attic feet. There is a link missing in the argument.

It had already been remarked by Peake and by Bunbury that the stade of six step lengths, assumed to equal 600 Greek feet, was very nearly the six-hundredth part of a degree, and Ball repeats it, still talking in stades. But it is better and more convincing to omit the stades and Greek feet, whose relation to the Parthenon is uncertain, and to put it that the length of the top step on the east front of the Parthenon as given by F. C. Penrose in the first of his 'Two Letters from Athens' to the Society of Dilettanti, dated 8 November 1846, is 101·341 English feet, or 30·8887 metres. The quadrant of the meridian, from Equator to Pole, is 10 002 288 metres (International figure) and the average length of one second of latitude is therefore 30·8713, or nearly the same. But we can do better. The mean radius of the Earth, on the same figure, is 6 371 220 metres, and a second of arc is 30·8885 metres, the Parthenon step 30·8887. Not even the Great Pyramid could do better than that.

Eratosthenes, two hundred years later, in his celebrated estimate of the size of the Earth, arrived at 700 instead of 600 stades for the length of a degree. Ball points out that he made only one measure, the meridian zenith distance of the sun at the solstice in Alexandria, and found it the suspiciously round number 1/50 the circumference of the circle, or 7° 12′ when it should have

been 7° 28′. And he made three assumptions, all wrong: that Syene was on the tropic, whereas it was 21′ north of it; that Syène was due south of Alexandria, whereas it is 3° 0′ east; and that the distance between the two was the round number of 5000 stades, whereas is is only 4544 stades of 185·3 metres in a direct line, and the north–south component is 4253 stades. These figures are all new, and useful in showing more clearly than ever before that Eratosthenes' result for the size of the Earth was the kind of estimate in round numbers one might make for ease in mental arithmetic, but not to be taken too seriously.

A. R. H.

THE DISCOVERY OF NEW SPAIN IN 1518 BY JUAN DE GRIJALVA. A translation of original texts with Introduction and Notes. By H. R. WAGNER. (Cortés Soc. New Series 2.) *Berkeley, Cal.: Cortés Soc.*, 1942. 10×7 *inches;* 208 *pages; illustrations and sketch-maps*

This is another of the volumes issued by the Cortés Society for the benefit of students of early Spanish discovery in the New World. It is concerned with the expedition of Juan de Grijalva, when part of the eastern coast of what is now Mexico was first sighted by Europeans. The most important of the several first-hand or very early accounts (except that of Bernal Diaz del Castillo) are gathered together: they comprise that of the cleric Juan Diaz; the letter of the Regimiento written at Vera Cruz; the details chronicled by Oviedo, apparently from material supplied by the pilot Alaminos; the brief accounts of Alonzo de Santa Cruz and of Gómara; the story of Las Casas, and of Cervantes de Salazar.

Mr. Wagner says frankly that these various accounts do not agree, but they form an invaluable contribution to the study of early discoveries in the New World of the period. His translation is lucid and almost literal, his Summary of the various accounts is competent; and his story of the expedition sufficient. But the notes might be fuller and more explanatory in regard to Spanish terms and customs.

L. E. J.

GENERAL

CHANCE OR DESIGN: a pioneer looks back. By GEORGE SEYMOUR FORT. *London: Robert Hale*, 1942. $8\frac{1}{2}\times5\frac{1}{2}$ *inches;* 180 *pages; illustrations.* 12*s* 6*d*

Mr. Fort gives a brief sketch of some of the more vivid incidents of a very varied career. Starting with farming in New Zealand for his health, and Oxford for his education, he proceeded to Australia to make his fortune. Although he did not succeed in making this in any of the occupations described in his book, it appears to have been the motivating force throughout. In Australia he taught for a short time, which he did not like; practised journalism for a shorter time, which he liked even less; and managed by a lucky accident to get the post of private secretary to Major-General Sir Peter Scratchley when he went to New Guinea as Special Commissioner for the Protectorate in 1885. The description of the difficulties of taking over the new territory is perhaps the most interesting part of the book. After the General's death the author became private secretary to Lord Loch, then Governor of Victoria. In the same capacity he followed Lord Loch when the latter took up his appointment as Governor of Cape Colony and High Commissioner for South Africa. But fortune and inclination led Mr. Fort to seek rougher paths. During the exciting days of prospecting in the early '90's he held many jobs in Rhodesia and Manicaland both for companies, individuals, and the Government. Throughout the autobiography is enlivened with short stories, frequently witty and entertaining.

D. R. C.

THE MONTHLY RECORD

ADDITIONS TO THE LIBRARY

The following books are among those recently presented by the publishers or bought for the Library, and not already noted in the *Journal*.

The second volume of Professor W. K. Hancock's 'Survey of British Commonwealth affairs,' dealing with problems of economic policy from 1919 to 1939, has been completed by the publication of Part two (R. Inst. Internat. Affairs: Oxford U.P., 1942). The whole forms a valuable and thought-provoking analysis of the structure and development of production and trade, and their inter-relations with political and social progress. Part I deals with the autonomous nations, Part II with the native populations of southern and west Africa under the impact of modern economic forces. These themes are related to current theories of imperialism, which are shown to require considerable modification when tested by concrete instances.

Two recent books on Russia are Sir John Maynard's 'The Russian peasant' (Gollancz, 1942) and John Scott's 'Behind the Urals' (Secker, 1942). The first is a series of essays on the rural communities, as they have developed in this century, and the present condition of the peasant, by a writer with administrative experience in India. Mr. Scott describes candidly his life in the industrial centre of Magnitogorsk.

'Modern India and the west,' edited by L. S. S. O'Malley (R. Inst. Internat. Affairs: Oxford U.P., 1942) is an important aid to the understanding of contemporary India. The sub-title, 'a study of the interactions of their civilizations,' indicates the general theme; the subjects treated include, besides politics and economics, religion, literature, education, law, and the press. The aim is to present a just estimate of the evolution which has taken place and of the forces which have prevented it from going farther. Shorter outlines are provided by T. A. Raman's 'India' (Oxford U.P., 1942) and Sir William Barton's 'India's fateful hour' (John Murray, 1942). Mr. Raman writes from the point of view of a nationalist who does not accept the policy of non-cooperation. Sir William Barton criticizes the claims of Congress, and analyses the conflicting interests within the party. Both make it clear that the ultimate problem is the low standard of living in the rural areas, with its far-reaching social and political implications.

The Institute of Pacific Relations published in 1941 a preliminary survey 'Aspects of Japanese agriculture,' by Shiroshi Nasu, of the Tokyo Imperial University. The monograph has a wide scope, and includes details on physical conditions, land use, productivity, and rural economics. In discussing the difficulties which arise from the predominance of rice growing (60 per cent. by value of all farm produce) in Japan proper and the increasing output in Formosa and Korea, the author describes the limitations to the expansion of fruit and vegetable production and stock raising, and recommends better use of forest and water resources, the setting-up of rural industries, and overseas migration.

A. L. Haskell in 'The Australasians' (A. and C. Black, 1943) gives a concise account of the discovery and first settlement of Australia and the establishment of the individual colonies. The treatment is not profound, but the style is lively. An important and much debated chapter in Australian exploration is covered by A. H. Chisholm's 'Strange new world' (Sydney: Angus and Robertson, 1941), largely an account of Leichhardt's expedition from the Darling

Downs to Port Essington, 1844–5, based upon the recently discovered papers of John Gilbert, the naturalist, who died on the journey. Readers may feel that it would have been more satisfactory to have printed the material in full, for the running commentary in which the extracts are embedded is not always worthy of the subject. The author, an avowed partisan of those who discredit Leichhardt's character, makes no serious attempt to assess his scientific achievements. 'Pacific treasure island,' by W. G. Burchett (Melbourne: F. W. Cheshire, 1941) is a description of New Caledonia, its history and resources, by an Australian journalist who urges the establishment of closer relations between the island and his country. The narrative concludes with the setting up of Free French authority. In 'High lights and flights in New Guinea' (Hodder and Stoughton, 1942) L. Rhys describes the development of the Morobe goldfields and the part played in it by air transport.

THOMAS JEFFERSON

To mark the two hundredth anniversary of the birth of Thomas Jefferson, the University of Michigan displayed a number of rare books, maps, and MSS. from the William L. Clements Library, illustrating the wide range of his interests. These are fully described in the Library's Bulletin, No. 38. During his long career Jefferson was intimately concerned with the extension of geographical knowledge on the North American continent in relation to the territorial expansion of the United States.

The first item is, appropriately, the 'Map of the most inhabited part of Virginia,' the best pre-Revolution map of the State, drawn by his father, Peter Jefferson, and Joshua Fry, engraved in London and published in 1751. In the negotiations for the administration of the territory west of the original thirteen States, Thomas Jefferson took a leading part, though all his suggestions were not embodied in the Ordinance of 1784. His MS. map showing his proposals for the division of the lands to the north-west and south of the Ohio river cannot now be traced, but a copy made by David Hartley the British Commissioner for the peace treaty of 1783 is in the Clements Library. For the fourteen new States shown thereon, Jefferson proposed names such as Sylvania and Polypotamia; three of these, Michigania, Illinoia, and Washington, have partly survived. Jefferson was also the author of a description of Virginia prepared at the request of a French diplomat anxious to increase his country's knowledge of her new ally. This was his 'Notes on the State of Virginia,' privately printed in Paris 1784–5: the first authorized edition appeared in London in 1787. A copy of the latter, lacking the map, is in the Society's Library. During Jefferson's term as President, when the Louisiana Purchase was carried through, his attention was also directed to the north-west; the result was Lewis and Clark's expedition, of which the first printed report appeared in the 'Message from the President of the United States communicating discoveries made in exploring the Missouri, Red River and Washita. . . .' Washington, 1806.

In addition to this material of geographical interest, Jefferson's work as a bibliographer and founder of libraries is also illustrated. His best-known collection was bought by the nation to form the foundation of the new Library of Congress, which replaced that destroyed in the war of 1812.

THE NETWORK OF WORLD TRADE

The characteristics of international commerce as it had developed by 1938 are discussed in 'The network of world trade,' a recent publication of the Economic Intelligence Service, League of Nations. The statistical information is conveniently arranged in groups of countries according to the nature of their pro-

ducts and requirements, so that the main routes of exchange are clearly indicated. Before this war, the magnitude of world trade was approximately equivalent to the national income of the United Kingdom. The composition of total exports were by value in 1937: foodstuffs, 22·1 per cent.; raw materials, 39 per cent.; manufactured goods, 38·9 per cent. During the 'thirties, as a result of the economic depression, the encouragement of agriculture in many European countries, and the preparation for war, the proportion of foodstuffs had decreased, and that of raw materials had risen, from 34·9 per cent. in 1928. The countries of south-east Europe for example were exporting oil seed and textile fibres to Germany. Over half the total trade was conducted in or with Europe: excluding that between countries in the same group, continental Europe took 27 per cent. of world imports, and non-continental Europe, mainly the United Kingdom, 25 per cent. If the figures for the United States and Japan are added, these four industrialized regions accounted for nine-tenths of world trade.

Exports, and to a lesser extent imports, were equally concentrated. Thus south-east Asia supplied 91 per cent. of the rubber and 81 per cent. of the coconut oil entering into world trade, and non-tropical South America 80 per cent. of the linseed: on the purchasing side the United Kingdom took four-fifths of all pork exports, and the United States seven-tenths of the silk. This concentration is partly due to geographical influences, *e.g.* differences in natural conditions, resources, accessibility, etc., but much more to variations in the supply of labour, productive land, and capital. Thus the requirements of the United Kingdom, where capital is abundant and land scarce, will differ from those of the United States, where both are plentiful but labour is normally scarce.

The interaction of these influences results therefore not in simple bilateral trade but in multilateral trade involving many countries. The tropical regions for example furnished two-fifths of the United States' imports, but took one-fifth only of her imports: on the other hand, the United States took 2 per cent. only of the exports of Oceania, but supplied 14 per cent. of the imports. For Great Britain however the tropics were important as a market rather than as a source of supplies, which were drawn from the Dominions, continental Europe, and the United States. It is pointed out also that the demands of the United Kingdom and the United States for primary products were complementary rather than competitive; the chief British requirements included foodstuffs, cotton, wool, and zinc, those of the United States silk, bananas, coffee, and rubber. Both however tended to compete with continental Europe, whose demands were more widely spread.

The more important economic regions can be arranged in a series so that each has an active trade balance with all the following regions, and an adverse balance with the preceding. This arrangement in broad divisions is: the Tropics; the United States; areas of recent settlement (*e.g.* Canada and Australia); continental Europe; non-continental Europe (mainly United Kingdom). The Tropics however have an adverse balance with the United Kingdom. These groups can be subdivided, the parts retaining their correct position; thus "other European countries" and "industrial continental Europe" are placed between "areas of recent settlement" and "non-continental Europe." The statistics summarized here do not take into account the production and transfer of gold. Final balances are of course affected by invisible exports, and the system was kept working before the depression by United States' credits. With regard to overseas investments, it is shown that, contrary to what might be expected, the United Kingdom had the largest adverse trade balances with countries in which her investments were smallest, British capital having

developed primary production for disposal in the world market, and not solely for the British.

THE WATER-SUPPLY OF BRITISH SOMALILAND

In the paper on the "Water-supply of British Somaliland" by Mr. A Beeby Thompson (*Geogr. J.* 101 (1943) 154) the photograph, 'Divide near Kasai,' was accidentally included, the scenery and geology of the Kasai district of Mukalla being practically identical with those of the Somaliland scarp.

OBITUARY

COLONEL SIR SIDNEY BURRARD, BART., K.C.S.I., F.R.S.

Sidney Gerald Burrard was the eldest son of Lieut.-Colonel S. Burrard, Grenadier Guards, who was the third son of the third baronet. He was born on 12 August 1860, at Lymington, Hants, a place with which his family had been connected for many generations. He told the writer of this memoir that he had been, in recent years, to Lymington, and had visited the parish church to see if there were any memorials of the family. He found one, but the tablet had been moved so high up on the wall that it was impossible to read the inscription. He commented in his own amusing fashion on this way of treating other people's ancestors.

Burrard was first sent to school at Uppingham, but was later transferred to Wellington, as the latter school was nearer his home. He passed into Woolwich at the head of the list and in his last term became Senior Under Officer, passing out with a commission in the Royal Engineers on 6 April 1879. After two years at the School of Military Engineering, Chatham, he was sent to Shorncliffe, and in 1883 was posted to India for service in the Military Works Department. In September 1884 he was transferred to the Survey of India and joined the Trigonometrical Branch of that famous department. He remained in the Survey of India until his retirement in September 1919, having completed thirty-five years' service on the Survey. His name is writ large in its records.

It was not long before he made an important technical discovery, connected with certain apparent errors in the closure of a number of arcs of longitude which had been measured during the years 1874–83. His old friend and colleague Sir Gerald Lenox-Conyngham, in a letter to *The Times*, has stated in general terms what this discovery was, and has, in a private note, explained how one night in 1889, whilst Burrard was at work in the observatory tent at Agra, it suddenly flashed into his mind that the cause of the apparent errors might be the use of the Gaussian method of collimating, and that it would be possible to eliminate this source of error. "In the course of time all the old work was recomputed and was found to yield perfectly satisfactory results. This discovery paved the way for the redetermination of the Longitude of India, which could not be undertaken with any confidence so long as these mysterious circuit errors were unexplained."

Burrard continued for some years to be employed upon the geodetic work of the Survey, chiefly carrying out refined observations for latitude and longitude. From 1896 to 1898 he was in charge of the Tidal and Levelling Operations. In 1899 he became the Superintendent of the Trigonometrical Branch and remained in that office until 1910, when he was appointed Surveyor-General of India, a worthy successor of Everest and Walker. He retired in 1919.

In all these busy years Burrard was always most ready to help those who asked for his advice. The present writer remembers how, in the spring of 1893, fifty years ago, he was finishing a trigonometrical field season in Burma, when he was unexpectedly directed to proceed to Rangoon, there to set up a transit instrument for the purpose of giving the correct local time to the Port of Rangoon. He wrote to Burrard for his advice as to the best method of procedure, and Burrard took an immense amount of trouble in his reply, explaining clearly and categorically the various steps for determining the three principal errors with which a transit instrument may be afflicted; how to correct for these and fix the instrument. The writer has always felt especially grateful to Burrard for his help in this emergency.

In 1901 Burrard published a paper entitled "The attraction of the Himalaya Mountains on the plumb-line in India." He discussed the latitude determinations in northern India, and the differences between these observations and the values derived from the great triangulation. He came to the conclusion that these differences were not random but systematic, and that a possible cause of such systematic deflections was the existence of "a hidden range of high density running across India, parallel to the Himalayas," many miles to the south of the foot of the mountains. The chief interest of this study was the linking up of the results of geodetic calculations with the forces which have created, and are still creating, the irregularities of the earth's surface.

In 1908 there was published 'A sketch of the geography and geology of the Himalaya Mountains and Tibet,' by Burrard and H. H. Hayden, Superintendent of the Geological Survey of India. In the 1st Edition, p. 53, it is stated that "The explanation of the observed phenomena, that is now accepted, is that an invisible chain of excessive density, parallel with the Himalayas, is underlying the plains of northern India: this buried chain is 150 miles distant from the foot of the mountains." The section in which this sentence occurs, dealing with *Observations of the Plumb-Line and Pendulum*, seems to have been omitted from the second edition of this work, published in 1933. The second edition, which was revised by Burrard and A. M. Heron, Superintendent of the Geological Survey of India, long after Burrard had retired, contains a mass of information about the geography and geology of the Himalaya and is quite indispensable for students of the subject, though it is rather difficult to find one's way about the book, partly because there is no general index.

Burrard was always interested in the question of place-names and upheld the official view of this Society that European names and invented names should be avoided as much as possible in dealing with Asiatic countries. He took a part in the discussion which was aroused by Sven Hedin's introduction of the term Trans-Himalaya. Eventually, writing in 1932, he said, "Twenty-three years have now passed since Sven Hedin found his new name opposed in India. The necessity of finding a scientific name for the Trans-Himalayan region of Tibet has of late years become urgent. Frequent endeavours have been made to find a Tibetan name, but they have all ended in disappointment. . . . The Survey of India has thus been led to recognize the force of Sven Hedin's arguments." Burrard was always open-minded and ready to change his views on the production of fresh evidence.

In 1913 this Society awarded him the Victoria Medal for his distinguished contributions to Geography and Geodesy during his service on the Survey of India. After his retirement he was not able to do much scientific work on account of his gradually failing eyesight, and he was not very often present at geographical gatherings, though he still took a great interest in the subject, especially as far as it concerned India. He did come up to that lively meeting in

May 1930, when Major Kenneth Mason read a paper on "Nomenclature in the Karakoram." Burrard took a prominent part in the discussion, in which many joined, notably Younghusband, Longstaff, Ryder, Bruce, Neame, Hinks, and Reynolds. There was a vigorous interchange of views of which the report is still good reading. One received the impression that Burrard was very alert and well informed. And here it should perhaps be mentioned that, many years afterwards, Professor Mason evolved a system of names for the whole Karakoram region which was approved by Burrard and accepted by the Survey of India, and all's well that ends well.

Burrard was elected a Fellow of the Royal Society in 1904, and was made a K.C.S.I. in 1914. He succeeded a cousin as seventh Baronet in 1933. After retirement in 1919 he bought a house at Farnborough, Hants, and lived there for the rest of his life. He died there on 16 March 1943, in his eighty-third year.

He married, firstly, Gertrude, daughter of Colonel C. T. Haig, R.E. She was a distinguished amateur artist who painted admirable portraits in oils. She died in 1928. There were two children. In 1935 he married again; his second wife was the daughter of Mr. and Mrs. Simons, of Canterbury.

Burrard was an able man, interested not only in his own special branch of science, but also in art, history, and music. He used to play the violin himself and enjoyed and understood music and was a good critic. He had an excellent sense of humour, which, after all, is chiefly a sense of proportion, and this must have been a help to him throughout the course of his life. It was always a pleasure to have a talk with him, for he was a good talker, and what is almost as valuable, and far more rare, he was a good listener. One was sure to hear sound views well expressed. All those of us who, in the past, had served or worked with him, and who in recent years had had occasional opportunities of reviving our friendship with him, deeply regret his death. C. F. A.-C.

MR. FRANCIS JOHN BATCHELOR

All Fellows of the Society who have had occasion to visit the Drawing Office will regret to learn that Mr. F. J. Batchelor died on April 28 after a brief illness, at the age of sixty-six. He was first employed by the Society more than fifty years ago as a boy in the Map Room at Savile Row, and after some years was transferred to the Drawing Office to be trained by Mr. Scharbau. By natural talent he became not only a most accomplished draughtsman but a repository of information on map projections, processes of reproduction, field astronomy, and all the devices of route surveys: much no doubt acquired from Mr. Reeves, but much also from his own reading. In the *Journal* for January last it was recorded how much the first hundred volumes owed to him. His most important single work was the Karakoram Map published in 1940. During the last few years of his life he had struggled against the disability of asthma, and was due to retire on pension; but he had lately seemed better, and his unexpected death at a time when he was hoping to carry on while his juniors were on military service is a serious loss to the Society.

MEETINGS: SESSION 1942–43

Seventeenth Meeting, 5 April 1943. The President in the Chair

Paper: Wave-trough experiments on beach profiles. By Miss Marjorie Sweeting

Eighteenth Meeting, 12 April 1943. The President in the Chair

Elections: Miss Muriel Agnes Arber, M.A., F.G.S.; Raymond MacQuarrie Beggs; John Henry Evans; Miss Kathleen Hart, B.SC.; Miss Dorothy Gertrude Hosegood; The Rt. Hon. Earl Kitchener; Captain Charles Douglas Knights; Lieut.-Col. William Charles Likeman; Alec Longland; Lieut. Donald James Dundas Maitland; Captain L. N. Norris-Rogers; Le Roy Robertson; Dr. Frank George Scott, B.D.S., D.M.D.; Major Claude Pennington Sparrow; Inst./Lieut. Edwin Frederick Winchester Sumner, R.N.

Paper: The coastal people of Kelantan and Trengganu, Malaya. By Dr. Raymond Firth

Nineteenth Meeting, 19 April 1943. The President in the Chair

Paper: The colour of Kashmir. By Captain J. B. L. Noel, with hand-coloured slides

Twentieth Meeting, 3 May 1943. The President in the Chair

Paper: The Jaz Murian Depression, Persian Baluchistan. By Dr. J. V. Harrison

Twenty-first Meeting, 10 May 1943. The President in the Chair

Elections: Professor Ignacy Balinski; Robert Richard Beckinsale; Rev. Basil Edward Bennett; Rev. Frederic J. Cutts, M.A.; Purushottam Ramchandra Joshi, M.A., LL.B., T.D.; George P. Kellaway, B.SC.; Lieut. Gordon Kellett, R.I.A.S.C.; Mrs. R. N. Lock, PH.D.; Major S. F. Markham, M.P.; Mrs. Philip Millin; John W. Pattinson; Henry L. Podmore, B.SC.; Henry G. Sandy; Charles Donald Stiff; James Ian Thackrah

Paper: Perspectives of the Near East. By Sir Percy Loraine

Twenty-second Meeting, 17 May 1943. The President in the Chair

Kodochrome Films. Algeria and Morocco. By Major G. W. Morey, R.A.M.C.